THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station
Beltsville, Maryland
Volume 37
December 15, 1953
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SEED-TREATMENT TEST FOR BUNT (TILLETIA CARIES) CONTROL IN WINTER AND SPRING WHEAT AT PULLMAN, WASHINGTON IN 1952-53

C. S. Holton and John Y. Woo

Several standard seed-treatment fungicides and experimental chemical materials were tested to determine their relative effectiveness in controlling seed-borne common bunt (Tilletia caries (DC.) Tul.) of winter and spring wheat at Pullman, Washington in 1952-1953. The materials tested and the results obtained are presented in Table 1.

The materials were applied to 250 cc. samples of Orin winter wheat and Red Bobs spring wheat in the form and at the rates indicated in Table 1. After applying the material the seed

Table 1. Relative effectiveness of fungicidal materials in the control of bunt in Orin winter wheat and Red Bobs spring wheat, grown from inoculated seed, treated as shown, and planted in triplicated rows at Pullman, Washington in 1952-53.

Material tested	Form	Rate oz./bu.	Average percent bunt in Winter wheat	Spring wheat
Check (Not Treated)	-		22.3	42.0
1. Ceresan M	Slurry	1/2	0.6	0.0
2. Agrox	Slurry	1/2	0.3	0.0
3. Mycon	Slurry	1/2	0.0	0.0
4. Mergamma	Slurry	2 1/2	0.0	1.0
5. Manzate	Slurry	1/2	2.3	2.0
6. Anticarie	Slurry	1/2	0.0	0.0
7. Puratized C13-1212	Slurry	1	0.0	0.0
8. Puratized C4-10	Slurry	1	0.0	0.0
Check (Not treated)	-	-	13.0	38.0
9. Tritisan	Slurry	1	3.0	10.0
10. Tritisan	Slurry	2	0.3	1.0
11. Brassicol	Slurry	1	2.6	7.0
12. Brassicol	Slurry	2	0.6	0.0
13. PCNB 20%	Slurry	1	5.3	1.0
14. PCNB 20%	Slurry	2	0.6	0.0
15. PCNB 75%	Slurry	1	0.0	0.0
16. PCNB 75%	Slurry	2	0.0	0.0
17. NP 1083-D	Slurry	2	0.0	0.0
Check (Not treated)	-	-	32.0	40.0
18. Velsicol (50-CS-46)	Slurry	1	0.3	0.0
19. HCB 24%	Slurry	1/2	1.3	11.0
20. 2-4 DCNB 70%	Slurry	1	18.6	4.0
21. Panogen	Liquid	1/2	1.6	0.0
22. Panogen	Liquid	3/4	2.3	0.0
23. Setrete	Liquid	1/2	0.6	0.0
24. Setrete	Liquid	3/4	0.6	0.0
25. M.E.M.A.	Liquid	1/2	2.0	0.0
26. #71 PMU	Liquid	3/4	0.3	0.0
27. Vancide 51	Liquid	2	6.0	0.0
28. Merculine	Liquid	1/2	0.3	0.0
Check (Not treated)	-	-	21.6	50.0

was agitated in closed glass jars until even distribution on the seed was assured. The treated seed was then stored in closed paper sacks for at least 24 hours before seeding. Smut percentages were determined by head counts. Counts were not made in rows having no smut. All rows had full and approximately equal stands.

The data presented in Table 1 indicate that most of the materials tested were highly effective in controlling bunt in both winter and spring wheats. They were generally more effective in the spring wheat test, despite the higher incidence of smut in this test. The four standard fungicides recommended for wheat seed-treatment in the Pacific Northwest (Ceresan M, Agrox, Panogen, and Anticarie) eliminated bunt in the spring-wheat test. In the winter-wheat test, however, only Anticarie of these four materials gave complete control. Panogen was least effective of the three standard mercury materials and less effective in this test than in those of previous years.

Among the materials that gave relatively poor average control were Manzate, Tritisan at one ounce, Brassicol at one ounce, PCNB (Pentachloronitrobenzene) 20% at one ounce, 2-4 DNCB (Dinitrochlorobenzene) 70% and Vancide 51.

The Puratized products (treatments 7 and 8), which are complex phenyl mercury compounds from Gallowhur Chemical Corporation, eliminated bunt in both tests, as also did N.P. 1083-D, a dinitrofluorobenzene compound from Penn Salt Company. Velsicol, an organic mercury compound from Velsicol Corporation, Chicago, Illinois, also was fairly effective. Treatment 19 (24% hexachlorobenzene) was not entirely effective on spring wheat. Perhaps it should have been applied at 3/4 or one ounce per bushel, since Anticarie, which is 40% HCB, is not always entirely effective at the 1/2 ounce rate.

Treatment 26 (phenyl mercury urea) at 3/4 oz/bu controlled bunt in winter wheat slightly better than did No. 25, methoxy ethyl mercury acetate, at the half-ounce rate.

U. S. BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING, DIVISION OF CEREAL CROPS AND DISEASES, IN COOPERATION WITH WASHINGTON AGRICULTURAL EXPERIMENT STATIONS.

SORGHUM SEED-TREATMENT TESTS IN 1953

R. W. Leukel and O. J. Webster

Seventeen fungicidal chemicals were tested on smut-infested seed of Sharon kafir and Leoti sorgo with regard to their effect on emergence in steamed and in infested soils, on field stands, and on control of covered kernel smut (Sphacelotheca sorghi (Lk.) Clint.).

The fungicides were applied to 500 cc samples in 1000 cc glass jars as described in previous experiments (1). Emergence tests were made in control chambers, and data on stand and smut control were obtained in field plots at Beltsville, Maryland, and at Lincoln, Nebraska.

With the exception of Mycon and Helixin, all the treatments improved the percentage of emergence in infested soil by amounts ranging from 9 to 19. The Helixin had been dissolved in alcohol, and failure to aerate the seed after treatment resulted in injury from the solvent. Mycon was not injurious, as shown by 93 percent emergence in steamed soil. However, it does not seem to act as a protectant, although it controlled smut perfectly.

At Beltsville, smut was controlled in Sharon kafir by all the treatments except N.P. 1083, which allowed 4 percent infection. In Leoti sorgo, however, eight of the treatments failed to effect perfect control. Mycon, which did not qualify as a seed protectant, was perfect as a seed disinfectant, while Orthocide, Vancide, Agrox, Mercusol, and Setrete, all apparently good protectants, failed to eliminate smut in Leoti. The failure of the three mercurials in this respect is especially puzzling, because mercury fungicides are recommended for smut control in those sorghum varieties whose seeds have persistent glumes. Actidione was applied as a 1 % dust to Leoti only and allowed 6.7 % infection.

Literature Cited

1. Leukel, R. W. 1951. Sorghum seed-treatment studies in 1951. U. S. Dept. Agr. Plant Dis. Reptr. 35: 451-452.

U. S. BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, DIVISION OF CEREAL CROPS AND DISEASES IN COOPERATION WITH THE NEBRASKA EXPERIMENT STATION

Table 1. Effect of treating seed with different fungicides on emergence of Sharon kafir in steamed and in infested soils, and on field stands and control of covered kernel smut in kafir and in Leoti sorgo in field plots at Beltsville, Maryland, and Lincoln, Nebraska. 1953.

Treatment				Sharon kafir						Leoti sorgo			
				Emergence		Increase in steamed soil	Field stands at		Smutted heads at Beltsville[a]	Field Stands at		Smutted heads at	
No.	Fungicide	Oz/bu	Form	Steamed soil	Infested soil		Beltsville	Lincoln		Beltsville	Lincoln	Beltsville	Lincoln
				%	%	Amount	%	%	%	%	%	%	%
1.	Check	---		89	73	16	55	77	75.6	70	70	50.0	14.3
2.	Arasan S.F.X.	1.5	Slurry	90	93	-3	69	84	0	76	71	0	0
3.	Phygon	1	Slurry	92	90	2	68	84	0	78	76	0	0
4.	Mycon	1	Slurry	93	68	25	55	76	0	68	71	0	0
5.	Orthocide 75	1	Slurry	89	91	-2	77	81	0	80	79	18.0	0
6.	P-5025	1	Slurry	86	83	3	72	83	0	79	78	5.0	0
7a.	Helixin	2.25	Liquid	71	71	0	43	56	0	--	--	---	---
7b.	Actidione	1	Dust	--	--	--	--	--	-	74	74	6.7	0
8.	Vancide	4	Liquid	93	93	0	62	83	0	75	72	2.0	0
9.	Ceresan M	0.5	Slurry	86	90	-4	62	86	0	72	73	0	0
10.	Check	---	---	94	75	19	51	76	69.4	68	66	71.0	4
11.	Ceresan M2X	0.25	Slurry	86	87	-1	71	82	0	70	71	0	0
12.	Agrox	0.5	Slurry	90	89	1	71	79	0	71	70	1.7	0
13.	Panogen	0.75	Liquid	81	88	-7	70	80	0	72	73	0	0
14.	Setrete	0.5	Liquid	92	92	0	61	82	0	73	72	11.1	0
15.	Mercusol	0.5	Liquid	92	89	3	64	85	0	70	72	26.0	0
16.	Puratized C-4-10	1.0	Dust	91	88	3	68	83	0	71	75	0	0
17.	Puratized C-13-1212	0.5.	Dust	94	89	5	64	83	0	73	72	0	0
18.	N.P. 1083	1.5	Dust	92	84	8	73	73	4.0	74	70	7.7	0

[a] Kafir did not head at Lincoln because of drought.

COOPERATIVE TESTS OF SEED-TREATMENT CHEMICALS ON SPRING WHEAT AND OATS IN 1953

R. W. Leukel

Field tests were carried out again in 1953 to determine the relative merits of several recent additions to the list of cereal seed-treatment fungicides in comparison with several standard treatments. The fungicides were applied to spring wheat and oats at the Plant Industry Station, and portions of the treated seed lots were sent to cooperators at stations in nine States. At each station the cooperator planted the seed in replicated rows 10 to 16 feet long, and later took the data on disease control. The cooperation of the following workers is gratefully acknowledged: D. C. Arny, Madison, Wisconsin; W. E. Brentzel, Fargo, North Dakota; C. S. Holton, Pullman, Washington; R. L. Kiesling, East Lansing, Michigan; B. Koehler, Urbana, Illinois; M. B. Moore, St. Paul, Minnesota; C. M. Nagel, Brookings, South Dakota, and C. W. Roane, Blacksburg, Virginia.

The generous cooperation of these workers in these periodic tests is invaluable even though no data were obtained at some stations because of unfavorable environmental conditions. This emphasizes the value of having such tests made concurrently at several locations. While one or more of these stations may fail to yield significant results for several seasons in succession because of unfavorable conditions, it is highly improbable that such conditions will obtain the same year at nine or more locations. This makes a reliable yearly test of such materials possible.

Materials and Methods

The following fungicidal materials, some of which were used as standards of comparison, were included in these 1953 tests:

Agrox -- 6.7% phenyl mercury urea (4% Hg); and
Mergamma -- 3.35% phenyl mercury urea (2% Hg) and 40% lindane: Chipman Chemical Company, Inc.

Ceresan M -- 7.7% ethyl mercury p-toluene sulfonanilide (3.3% Hg): E. I. du Pont de Nemours & Co., Inc.

Mycon -- 7.7% methyl arsenic sulfide: Pittsburgh Coke & Chemical Co.

Orthocide 75 -- 75% captan; and
Orthocide Seed Protectant -- 50% captan and 16.5% lindane: California Spray-Chemical Corp:

Helixin B -- An antibiotic: supplied by C. C. Leben, Madison, Wisconsin.

M.E.M.A. -- 6.35% methoxy ethyl mercury acetate (4% Hg); and
M.E.M.L. -- 6.35% methoxy ethyl mercury lactate (4% Hg): Chipman Chemical Company, Inc.

Panogen -- 2.2% methyl mercury dicyan diamide (1.5% Hg): Panogen Inc. (Ringwood Chemical Company).

Setrete -- 7% phenyl mercury ammonium acetate (4.16% Hg): W. A. Cleary Corporation.

Mercusol -- 2% phenyl mercury salicylate and 20% copper resinate; and
Fermuline -- 8% phenyl mercury salicylate and 10% iron octoate: H. L. Woudhuysen & Associates.

Vancide 51 -- 30% of the sodium salts of dimethyl dithiocarbamic acid and 2-mercapto-benzothiazole: -- Niagara Chemical Division, Food Machinery and Chemical Corporation.

Seed of bunt-susceptible Red Bobs wheat, along with the bunt (Tilletia caries) to inoculate it, were supplied by C. S. Holton. The seed inoculated with bunt of 80-mesh fineness at a spore dosage of 1 to 200.

Seed of Canadian oats, naturally infected with both loose (Ustilago avenae) and covered (U. kolleri) smuts, was furnished by H. C. Murphy, Ames, Iowa. In a preliminary test in the greenhouse, under conditions highly conducive to infection, 30 percent of the plants were infected.

In treating the seed, a 500 cc sample was used for each material tested. This volume is convenient for testing fungicides on cereals because it is 1/70 of the volume of a bushel, and therefore simplifies the conversion of ounces-per-bushel to grams-per-sample. If the desired rate of fungicide application is one ounce (28.34 grams) per bushel, a 500 cc sample will require 1/70 of 28.34 grams or 0.405 gram. Rates of 1/2, 3/4, 2, 3, and 4 ounces per bushel are easily converted to 0.2, 0.3, 0.8, 1.2 and 1.6 grams per 500 cc sample. This eliminates calculations incidental to differences in the bushel weight of different seed lots of the same cereal, or of different cereals. It also avoids errors involved in treating samples of light chaffy seed as compared with plump heavy seed. A weighed bushel of light seed should receive more fungicide than a weighed bushel of heavy seed, for it may be 10 to 15 percent greater in volume. On a weight basis, however, the light chaffy seed receives less fungicide per measured bushel than does the heavy seed.

Four of the materials tested were used in both dust and slurry forms, two were used as slurries only, and eight were used as liquid treatments. The materials applied as slurries or as liquids were mixed with the proper amount of water so that 3 cc of the mixture contained the correct amount of chemical to treat 500 cc of seed at the desired rate. For the 1/2 ounce per bushel rate, for example, 10 grams of dust or 10 cc of liquid chemical were used in 150 cc of water-chemical mixture. For the one-ounce-per-bushel rate, 20 grams or 20 cc were used in 150 cc of mixture.

The treatments were applied in glass jars of 1000 cc capacity. The dusts were carefully weighed on a sensitive balance, and the slurries and liquid treatments were measured by means of a pipette. One end of a three-foot length of 1/8 inch rubber tubing was slipped over the upper end of the pipette as a safety measure. After inserting the lower end of the pipette into the 150 cc of slurry or liquid treatment, the operator blew into the tubing, not only to agitate the liquid or slurry, but also to blow out any poisonous fumes that might have gone up into it. The 3 cc of slurry or liquid was then drawn into the pipette and directed against the insides of the jar. The jar cover was then screwed on tightly and the jar was shaken immediately to distribute the chemical. The pipette was thoroughly cleaned after each application. After all the fungicides had been applied, the grain in the jars was tumbled for 20 minutes in a motor-driven contrivance constructed for that purpose. The covers were then loosened and the treated seed was allowed to remain in the jars for at least 48 hours. It was then packeted for planting at the different stations.

Germination Studies

One week after treatment, three samples of 100 seeds each from each of the treated and untreated lots of wheat were planted in soil in metal pans 4 x 8 x 2 inches. The soil had been inoculated with Fusarium culmorum, F. graminearum, F. moniliforme, and Helminthosporium sativum. Similar plantings were made in steamed uninoculated soil. The pans were placed on wet blotters in larger covered pans and kept at 15° C until emergence. Glass plates were then substituted for the metal covers, and fluorescent lights were used to induce normal growth. Emergence counts were made eight days after planting.

The plants were then allowed to grow in the pans in the greenhouse for eight days more, when a count was made of the plants showing symptoms of seedling blight. These data and the data on emergence are presented in Table 1. Germination studies were not made on the treated oat seed.

Experimental Results

Emergence of Red Bobs wheat in steamed soil (Table 1) was not affected significantly by any of the treatments except Helixin B. This material had been applied dissolved in ethanol, and failure to aerate the seed after treatment resulted in injury.

In the inoculated soil, emergence from untreated seed averaged 86 percent, and 15 of the treatments seemed to increase the percentage of emergence by amounts ranging from 4 to 11, or an average of 8. Only Helixin B caused a significant decrease in emergence. This was due to the alcohol solvent.

Five mercurials seemed to excel in reducing the amount of seedling blight in wheat seedlings grown in infested soil. The non-mercurials Vancide 51 and Orthocide 75 were less

Table 1. Effect of seed treatment of Red Bobs wheat on emergence at 15° C, on subsequent seedling blight in infested[a] soil in the greenhouse at Beltsville, Md., and on infection by bunt in field plots at five stations[b], in 1953.

Seed treatment					Percent emergence in soil		Percent seedlings infected[c]	Percent smutted heads in field plots					
No.	Material	Form	Oz/bu	Active ingredient %	Steamed	Inoculated		Pullman Wash.	St. Paul Minn.	Beltsville, Maryland	Fargo N. Dak.	Madison Wis.	Average of stations
1.	Check	---	---	---	95	85	58.8	81.4	51.0	47.0	4.3	0.8	36.9
2.	Agrox	Dust	0.5	6.7	95	95	1.4	1.9	0.6	0	t	0.1	0.5
3.	Ceresan M	Dust	0.5	7.7	96	94	3.2	0	0.2	0	0	0	t
4.	Mycon	Dust	1.0	7.7	95	91	52.9	12.2	0.8	1.0	t	0	2.8
5.	Mycon	Dust	2.0	7.7	92	83	60.0	0.9	0	1.0	0	0	0.4
6.	Orthocide 75	Dust	.75	75.0	95	94	14.5	32.8	1.1	23.0	0	0.2	11.4
7.	Helixin B[d]	Liquid	2.5	?	41	39	24.6	0	0	0	0	0	0
8.	MEMA[e]	Liquid	0.5	4.0	98	97	14.1	0	0	0	0	0	0
9.	Vancide 51[e]	Liquid	4.0	30.0	96	96	10.7	0	0	0.1	0	0	t
10.	Panogen conc.	Liquid	0.75	2.2	91	90	5.9	0	0	0	0	0	0
11.	Check	---	---	---	97	87	59.8	88.0	47.5	45.0	2.9	0.8	36.8
12.	Panogen[e]	Liquid	0.75	2.2	98	97	12.1	0	0	0	0	0	0
13.	Setrete[e]	Liquid	0.5	7.0	97	88	3.0	0	0	0	0	0	0
14.	Fermuline[e]	Liquid	0.75	8.0	95	92	11.6	0	0	0	0	0	0
15.	Agrox	Slurry	0.5	6.7	89	83	2.0	0	0	0	0	0	0
16.	Ceresan M	Slurry	0.5	7.7	97	97	7.2	0	0.2	0	0	0	t
17.	Mergamma	Slurry	2.0	3.3	89	86	6.9	0	0	0	0	0	0
18.	Mycon	Slurry	1.5	7.7	95	90	51.0	0	0	0	0	0	0
19.	Orthocide 75	Slurry	0.75	75.0	95	93	14.5	31.0	0.4	24.0	0	0	11.1
20.	Orthocide Seed Protectant	Slurry	1.5	50.0	98	91	41.0	19.5	1.2	20.3	0	0	8.2

[a] Soil was inoculated with Fusarium culmorum, F. moniliforme, F. graminearum and Helminthosporium sativum.

[b] No results of significance were obtained at four other stations because of unfavorable conditions.

[c] Data taken 8 days after emergence counts had been made.

[d] Furnished by C. C. Leben. Material was dissolved in ethanol, and failure to aerate seed after treatment caused injury.

[e] Diluted so that 3 cc furnished proper dosage for 500 cc sample.

effective, while Mycon showed no improvement over the check.

Field data on bunt control were obtained from five stations (Table 1). Infection from untreated seed at these stations ranged from an average of only 0.8 percent at Madison to 84.7 percent at Pullman. Complete control of bunt at all five stations was obtained by Helixin B, MEMA, Panogen, Setrete, Fermuline, Agrox slurry, Mergamma slurry, and Mycon slurry. It was reduced to less than 0.1 percent by Ceresan M (dust and slurry) and Vancide 51. Orthocide 75 (dust and slurry) allowed slightly over 11 percent infection, and Orthocide Seed Protectant 8.2 percent. At four stations, the wheat was rusted so severely that data on bunt could not be obtained.

The average percent of smut in Canadian oats (Table 2) from untreated seed ranged from 16 percent at Urbana to less than 1 percent at Fargo, and averaged 8.6 percent for eight stations. Panogen and Ceresan M slurry elimated smut at all stations; Ceresan M dust, Helixin B and Mycon slurry (1.5 oz./bu.) reduced infection to 0.1 percent or less; five other treatments averaged less than 1 percent; and seven ranged from 1.2 to 4 percent infection.

The relatively low percentages of infection by oat smuts in the rows grown from untreated seed at all of the stations indicate that environmental conditions after planting were not highly conducive to infection. As stated previously, 36 percent of the oat plants grown in the greenhouse were infected. These plants had been grown to emergence at 25°C, in soil adjusted to 40 percent of its water-holding capacity.

Discussion

The belief that seed-treatment fungicides in general are more effective when used as slurries than when they are applied in dust form, seems to be only faintly supported by the results with Agrox, Mycon, and Orthocide on wheat and Ceresan M and Mycon on oats. Results with Agrox and Orthocide on oats indicate the opposite, also very faintly. These differences seem too small to be significant.

Which of the effective materials a grower will use will be determined largely by availability, price, familiarity with its use, and lack of disagreeable features.

The many inquiries received as to what seed-treatment materials are already or soon may be on the market, their composition and uses, their approximate cost, and where they can be obtained, makes it desirable to present some of this information here.

Questionnaires were sent to chemical companies and other concerns that might be interested in the production or marketing of seed-treatment fungicides. They were asked to give the following data on the materials that they were manufacturing or marketing:

1. Chemical name or trade name of product.
2. Name and percentage of active ingredient.
3. Crop seeds for which recommended and rates of application.
4. Forms in which used (dust, slurry, liquid, gas).
5. Diseases controlled by it.
6. Unit cost.

The promptness and courtesy shown in their replies indicated the keen interest of these companies in the field of seed-treatment chemicals, even though some of them are not now engaged in making or marketing such materials. The materials listed, the concerns producing or marketing them, and the uses for which the manufacturers recommend them are as follows:

CALIFORNIA SPRAY-CHEMICAL CORP.

Orthocide 75 -- 75% captan, used as a dust or slurry for cereals, cotton, grasses, legumes, and some vegetables, for the control of bunt, sorghum kernel smuts, seed rot, seedling blight, and damping-off.

Ortho Seed Guard -- 25% captan and 25% lindane, used as a dust for cotton, corn, sorghum, barley, oats, and rye, for the control of seed rot, damping off, wireworms, and seed-corn maggots.

Isotox-PMA Seed Treater -- 50% lindane and 2.5% phenyl mercuric acetate, used as a dust or slurry for bunt and wireworms in wheat.

CHIPMAN CHEMICAL COMPANY, INC.:

Agrox -- 6.7% phenyl mercury urea, used as a dust or slurry for cereals, flax, cotton, and certain other seeds, for the control of seed decay, damping off, certain cereal

Table 2. Effect of seed treatments on infection by loose and covered smuts in Canadian oats, grown from naturally-infected seed, treated as shown, and sown in field plots at stations in eight States, 1953.

Seed Treatment				Percent of heads smutted								
No.	Material	Form	Oz./bu.	Urbana Ill.	Pullman Wash.	Beltsville Md.	Brookings S. Dak.	Blacksburg Virginia	Madison Wis.	St. Paul Minn.	Fargo N. Dak.	Average
1.	Check	---	---	12.0	12.8	11.0	6.5	9.0	6.4	3.8	0.3	7.7
2.	Agrox	Dust	0.5	0.6	1.1	0	1.5	0.5	0.1	0.6	0	0.6
3.	Ceresan M	Dust	0.5	0	0	0	1.0	0	0	0	0	0.1
4.	Mycon	Dust	0.5	3.1	6.0	0.7	2.0	2.5	0.9	0	t	1.9
5.	Mycon	Dust	1.0	0.4	0.4	0.1	0.5	0.2	0.4	0.4	t	0.3
6.	Orthocide 75	Dust	0.75	2.2	4.7	3.0	3.0	3.0	1.1	0.4	t	2.2
7.	Helixin B[a]	Liquid	1.5	0	0	0	1.0	0	0	0	0	0.1
8.	MEMA[b]	Liquid	0.5	1.2	0.8	2.0	1.5	1.0	1.2	1.8	t	1.2
9.	MEML[b]	Liquid	0.5	0.3	0	0.1	0	0.2	0.1	0	0	0.1
10.	Panogen (con.)	Liquid	0.75	0	0	0	0	0	0	0	0	0
11.	Check	---	---	20.1	11.4	9.0	10.5	7.0	9.1	7.2	0.6	9.4
12.	Panogen[b]	Liquid	0.75	0	0	0	0	0	0	0	0	0
13.	Setrete[b]	Liquid	0.5	1.1	0.1	0.1	0	1.0	0.6	0.6	0	0.4
14.	Mercusol[b]	Liquid	0.5	7.5	6.8	3.5	6.5	4.0	2.2	1.4	t	4.0
15.	Agrox	Slurry	0.5	2.5	3.4	0.4	2.5	2.0	0.8	0	t	1.5
16.	Ceresan M	Slurry	0.5	0	0	0	0	0	0	0	0	0
17.	Mergamma	Slurry	2.0	0.3	0.6	0	0.5	0.2	0	1.0	t	0.3
18.	Mycon	Slurry	1.5	0	0	0	0	0	0	0.2	0	t
19.	Orthocide 75	Slurry	0.75	5.2	3.7	3.5	5.0	2.5	1.5	1.8	t	2.9
20.	Orthocide Seed Protectant	Slurry	1.5	3.8	5.6	2.3	4.0	2.5	1.9	2.2	0	2.8

[a] Supplied by C. C. Leben

[b] Diluted so that 3 cc contained proper amount of chemical for 500 cc sample of seed.

Table 3. Estimated percentage of seed grain that was treated before being sown in sampled localities of North Dakota, Minnesota and South Dakota, 1946 to 1953.

State	Percent of seed treated before sowing in							
	1946	1947	1948	1949	1950	1951	1952	1953
North Dakota	58	69	67	72	72	74	75	69
Minnesota	47	73	64	70	65	67	64	64
South Dakota	19	47	42	54	55	54	50	60
Three-State Averages*	47	66	62	68	67	68	66	65

* Weighted average.

smuts, barley stripe (Helminthosporium gramineum), and certain cotton diseases.

Mergamma -- 3.35% of phenyl mercury urea plus 40% of lindane, used as a dust or slurry for the control of wireworms and false wireworms and the cereal diseases mentioned under Agrox above.

MEMA -- 11.2% beta acetoxymercuriethyl methyl ether, used as a liquid for the control of certain diseases of small grains, sorghum, and cotton.

W. A. CLEARY CORPORATION:

Setrete -- 7% phenyl mercuric ammonium acetate, used as a liquid for wheat, barley, oats, sorghum, and flax, for the control of seed decay, seedling blight, damping off, and certain seed-borne cereal smuts.

DOW CHEMICAL COMPANY:

Dow 9-B Seed Protectant -- 32% zinc trichlorophenate, used as a slurry for treating cotton seed for the control of anthracnose (Glomerella gossypii) and certain other soil-borne diseases.

E. I. DUPONT DE NEMOURS & CO., (INC.)

Semesan -- 30% hydroxymercurichlorophenol, used as a dust or solution for bulbs and for seed of vegetables, flowers, and grass, for the control of bulb-rots, seed rot, and damping off.

Semesan-Bel -- 12% hydroxymercurinitrophenol and 3.2% hydroxymercurichlorophenol, used as a liquid treatment for potatoes and sweetpotatoes, for the control of Rhizoctonia, scab (Streptomyces), scurf (Monilochaetes) stem rot, and seed-piece decay.

Arasan -- 50% thiram, used as a dust for peanuts, sorghum, corn, vegetables, grasses, and certain legumes, for the control of seed decay, damping off, and sorghum kernel smuts.

Arasan SF-X -- 75% thiram, used as a slurry for the same purposes described for Arasan.

2% Ceresan -- 2% ethyl mercury chloride, used as a dust or solution for cotton seed, peas, and narcissus bulbs, for the control of seed decay and damping off of all seeds, angular leaf spot (Xanthomonas malvacearum) and anthracnose of cotton, and basal rot (Fusarium) of narcissus.

New Improved Ceresan -- 5% ethyl mercury phosphate, used mostly as a dust for seeds of cotton, cereals, peas, flax, and sugar beets, and gladiolus bulbs, for the control of seed decay and damping off of all seeds, angular leaf spot and anthracnose of cotton, Fusarium rot of gladiolus, and certain seed-borne smuts and some other diseases of cereals.

Ceresan M -- 7.7% ethyl mercury p-toluene sulfonanilide, used as a dust or slurry for seeds of cotton, cereals, flax, and sugar beets, and for gladiolus bulbs as described for New Improved Ceresan.

Ceresan M-2X -- 15.4% ethyl mercury p-toluene sulfonanilide, used as a slurry as described for Ceresan M but at half the rate of application.

Dupont I and D Seed Protectant -- 56% thiram plus 14% lindane, used as a slurry for sweet corn and beans, for the control of seed decay, damping off, and soil insects.

GALLOWHUR CHEMICAL CORPORATION:

Gallotox -- 7% phenyl mercuric ammonium acetate, for treating seed of cereals, flax, and cotton as described for Setrete, which is the same compound.

GEIGY COMPANY, INC.:

Gytrete -- 7% phenyl mercuric ammonium acetate, similar to Setrete and Gallotox previously mentioned.

Geigy Lindane 25 W -- 25% lindane, for corn, small grains, peas, cotton, and some other seeds for combating wireworms.

Geigy SP -50-- 48% chloranil, for use as a slurry on seed of alfalfa, beans, peas, and flax, for combating seed decay and damping off.

NAUGATUCK CHEMICAL DIVISION, UNITED STATES RUBBER COMPANY:

Spergon -- 96% chloranil (tetrachloro-para-benzo quinone), for use as a dust on seed of corn, sorghum, rice, beans, peas, soybeans, vegetables, and certain other crops, for the control of seed rot, damping off, and some other diseases.

Spergon-SL -- is a slurry formulation, and Spergon-DDT-SL includes DDT for combating certain insects.

Phygon -- 50% 2,3-dichloro-1,4-naphthoquinone, for use as a dust or a slurry on seed of corn, rice, sorghum, alfalfa, sugarbeets, and some vegetables. It is combined in some formulations with DDT to combat certain insects.

Thiram -- 50% tetramethyl thiuram disulfide, similar to Arasan previously mentioned, used mostly in dust form.

Thiram Naugets -- a 75% product intended for use as a slurry.

NIAGARA CHEMICAL DIVISION, FOOD MACHINERY AND CHEMICAL CORPORATION:

Vancide 51 -- 30% of the sodium salts of dimethyl dithiocarbamic acid and 2-mercaptobenzothiazole, is a liquid fungicide for use on wheat and sorghum for controlling bunt and sorghum kernel smuts.

PANOGEN, INC. (RINGWOOD CHEMICAL CORPORATION, RINGWOOD, ILL.):

Panogen -- 2.2% methyl mercury dicyan diamide, a concentrated red liquid for treating seed of small grains to combat seed-borne diseases such as bunt, oat smuts, barley stripe and covered smut (Ustilago hordei).

PENNSYLVANIA SALT MANUFACTURING COMPANY:

Pentrete -- 7% phenyl mercuric ammonium acetate is similar to Setrete and Gytrete previously mentioned.

PITTSBURGH COKE & CHEMICAL CO.:

Mycon -- 7.7% methyl arsenic sulfide. This product has been tested on small grains and sorghum for several seasons and offers considerable promise as a non-mercuric treatment for these cereals.

PLANT PRODUCTS CORPORATION:

Tritisan -- 20% pentachloronitrobenzene used as a dust for control of bunt in wheat.

H. P. ROSSIGER AND COMPANY:

Anticarie -- 40% hexachlorobenzene used as a dust or slurry for the control of bunt in wheat.

Information furnished on the relative prices of fungicides in large and small lots was somewhat incomplete. Mercurials in dry form range from about $1.10 to $1.50 per pound in quantities of one pound or less, down to 80 cents per pound or less in 50- to 100-pound containers. The liquid mercurials range from $1.25 per pint in one-pint containers down to 80 cents per pint in 30-gallon drums. This makes the cost of materials for treating seed at 1/2 ounce per bushel range from as low as 2.5 cents per bushel to almost twice that amount. Higher rates of application would cost proportionately more.

The non-mercurial organic fungicides on which price data were received ranged from 60 cents to $1.75 per pound in 100-pound containers, and from 70 cents to $3.30 per pound in containers of one pound or less. These materials usually are applied at heavier dosages than are the mercurials, and therefore can be more expensive per bushel of seed treated.

The Market for Seed-Treatment Fungicides

Inquiries are frequently received concerning the percentage of seed-grain that is treated before sowing. Accurate information on this subject is not available and is not easily obtained.

For the past nine years, R. H. Peavy and Company, who operate about 200 elevators in Minnesota and the Dakotas, collected such information in the areas serviced by their elevators. These data are summarized in Table 3.

The potential market for seed-treatment fungicides in the United States is a matter of interest to all those concerned with the manufacture and sale of these materials. The approximate amount of fungicidal material that would have been required to treat all the seed of 17 important crops sown or planted in 1950 was calculated from the figures on the acreage in 1950 as given in "Agricultural Statistics" published in 1951 by the U. S. Department of Agriculture.

Table 4. Calculated amount of chemcial fungicides that would have been required to treat the seed of 17 field crops sown or planted in 1950, if applied to the seed at one ounce per bushel.

Crop	1950 U. S. acreage [a]	Seed required	Seeding rate per acre		Fungicide required	Usual rate of application	Weight per bu.
	1000 acres	1000 bu.	bu.	lbs.	tons	oz./bu.	lbs.
Wheat	71,396	85,675	1.2		2,677.0	0.5-2	60
Rye	3,720	4,836	1.3		151.1	0.5-2	56
Rice	1,608	4,181	2.6		130.7	1-2	45
Corn	84,370	11,299.6		7.5	353.1	1-2	56
Oats	46,642	111,940.8	2.4		3,498.2	0.5-1	32
Barley	13,235	22,499.5	1.7		703.1	0.5-1	48
Sorghum	16,587	2,310		7.8	72.2	0.5-2	50-56
Cotton	18,613	18,613	1.0		581.8	3-4[b]	32
Flax	4,064	2,844	0.7		88.9	2-4	56
Peanuts	2,927	2,561		35.0	80.0	1-2	33-45
Soybeans	15,408	15,408	1.0	60.0	481.5	1-2	60
Field beans	1,632	1,632	1.0	60.0	51.0	1-2	60
Field Peas	240	480	2.0		15.0	1-2	60
Cowpeas	1,183	1,479	0.8		37.0	1-2	60
Broomcorn	186.5	15		4.0	.5	0.5-2	50
Potatoes	1,866	37,320	20.0		1,166.3	(dip)	60
Velvet beans	934	467		30.0	14.6	1-2	60
Totals	284,907.5	323,264.9	---	---	10,102.0	---	---

[a] Based on "Agricultural Statistics" 1951.
[b] Per Cwt.

These estimates are presented in Table 4. No claim is made for their accuracy, since the amount of fungicide required for any crop, as governed by the seeding rate per acre and and the rate of applying the fungicide, varies considerably in different areas. But as calculated here, the potential market for 10,102 tons or 20,204,000 pounds of fungicide would have a value of about 15 to 30 million dollars annually. The value of the 7585 tons required for cereals alone could range from 10 million to over 20 million dollars. It is highly improbable, of course, that all of the cereal seed sown in any one year will be treated.

DIVISION OF CEREAL CROPS AND DISEASES.

SEED TREATMENT TRIALS FOR CONTROL OF HEAD SMUT IN MOUNTAIN BROME IN 1953

Jack P. Meiners and Sherl M. Dietz

Results of seed treatment tests to control head smut (Ustilago bullata Berk.) in mountain brome (Bromus marginatus Nees.) have been reported previously.[1] Similar tests were made in 1953 to provide an additional years's data on materials that looked most promising in the previous tests. Methods used were the same as those used in the previous tests. One new material, Setrete, was added.

The results, which are summarized in Table 1, are similar to those obtained previously. The volatile mercurials, Panogen and Ceresan M, at certain dosages gave adequate control, whereas Arasan, Arasan SF, Setrete, and Mergamma did not provide effective control at any dosage.

Table 1. Effect of seed treatments on the incidence of head smut in Bromar mountain brome.

Material	Dosage oz./bu.	Method of application	Slurry concentration lbs./gal.*	Bu. seed/ gal. slurry	Percent smut
Untreated	---	---	---	---	100.0
Ceresan M	0.5	Slurry	1	32	11.3
	1	"	2	32	2.5
	0.5	"	0.5	16	0.4
	1	"	1	16	0.0
	1.5	"	1.5	16	0.0
	0.5	Dust	---	---	0.9
	1	"	---	---	0.0
	1.5	"	---	---	0.0
	2	"	---	---	0.0
Arasan SF	4	Slurry	4	16	15.0
Arasan	4	Dust	---	---	2.5
	6	"	---	---	5.3
Panogen	0.5	Slurry	1	32	12.6
	0.75	"	1.5	32	5.3
	1	"	2	32	2.1
	0.5	"	0.5	16	4.6
	0.75	"	0.75	16	0.5
	1	"	1	16	0.3
	0.5	Liquid	---	---	11.7
	0.75	"	---	---	0.7
	1	"	---	---	0.3
Setrete	1	Slurry	1	16	92.0
Mergamma	4	Dust	---	---	11.0
	6	"	---	---	6.1

*Pounds of material per gallon of water

[1] Meiners, Jack P. 1953. Seed treatment for control of head smut in mountain brome in 1952. Plant Dis. Reptr. 37: 152-153.

As in the previous test, Ceresan M was tried at several dosages, both as a slurry and as a dust. At one ounce or more per bushel the dust eliminated the smut. In the Ceresan M slurry treatments, different slurry concentrations at different dosages were compared. The more dilute concentrations at each dosage were most effective. Probably this was due to the better coverage obtained with the greater volume of slurry. The smut was reduced to less than 1 percent at the 1/2 ounce per bushel rate, and was eliminated at 1 ounce or more per bushel when the slurry was applied at the rate of 1 gallon per 16 bushels of seed.

Similar results were obtained with Panogen. This material was applied at various dosages as a liquid (undiluted) or slurry. It did not completely eliminate the smut at any dosage, but at 3/4 ounce or more per bushel, either the undiluted liquid or the slurry when used at the rate of 1 gallon per 16 bushels of seed reduced the smut to less than 1 percent.

Arasan, which has been recommended for control of head smut, did not eliminate the smut although it reduced it considerably. However, on the basis of the results from the tests during both years, it does not give adequate control and can no longer be recommended.

On the basis of two years' results which were nearly identical, Ceresan M and Panogen are recommended for treatment of mountain brome seed to control head smut. Ceresan M may be used either as a dust or a slurry, and Panogen may be used in concentrated or dilute form. The dosage in any case should be 1 ounce per bushel and the slurry should be used at such a concentration that not less than 1 gallon is applied to 16 bushels of seed.

WASHINGTON AGRICULTURAL EXPERIMENT STATIONS, PULLMAN, WASHINGTON, IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING, DIVISION OF FORAGE CROPS AND DISEASES AND THE SOIL CONSERVATION SERVICE, DIVISION OF NURSERIES, UNITED STATES DEPARTMENT OF AGRICULTURE.

POSSIBLE DESIRABLE GERMPLASM IN NEW OAT INTRODUCTIONS GROWN IN FLORIDA AND NORTH CAROLINA IN 1952-53

R. W. Earhart and J. G. Moseman[1]

In the Coastal Plains region of Southeastern United States, crown rust, Puccinia coronata avenae Eriks. & E. Henn., and stem rust, P. graminis avenae Eriks. & E. Henn., are currently rated as the most serious oat diseases. The oat disease situation in this area is continually changing and host germ plasm carrying resistance to the new forms of the common diseases is needed to meet these changes.

In the fall of 1952, the 86 newly introduced varieties and selections of oats grown that year in the detention nursery at Sacaton, Arizona, were grown at Gainesville, Florida and Statesville, North Carolina.

Table 1. Disease reactions and forage ratings of 14 new oat introductions at Gainesville, Florida and Statesville, North Carolina in 1952-53.

P. I. No.	Variety or selection	Origin	Reaction[a] to Mosaic %	Mosaic Type	Crown rust %	Crown rust Type	Stem rust Type	Forage rating
193448	Rothenburger	Scotland	5	M	50	CS	R	Medium
195894	320	Morocco	0	-	40	CS	-	Medium
197277	Bulk Sel. 212	Argentina	0	-	tr	R-I	I - S	Medium
197278	D L M 3	Argentina	80	M	0	HR	S	Good
197279	La Estanzuela Fa au 12	Argentina	100	VS	0	HR H	S	Good
197280	La Prevision	Argentina	0	-	0	HR	I	Good
197788	2206	Australia	20	S	30	R-CS	S	Good
197791	2250	Australia	100	M	tr -10	R-S	I	Good
197794	2296	Australia	0	-	0-10	HR-S	R	Excellent
197795	2298	Australia	20	S	50	S	I - S	Medium
197798	V R A F.W 3774	Australia	100	S	0-10	HR-S	-	Good
198219	Bage 1419/36 50-2626	Sweden	50	S	0	HR	I - S	Good
198220	B.B. M3 50-2629	Sweden	40	M	0-10	HR-CS	CS	Good
198227	Urugland 50-2779	Sweden	20	S	0	HR	CS	Good

[a] The degree of infection is indicated by the percent of plants infected. The type of reaction on the plants is as follows:

To mosaic: VS=very severe; S= severe; M= mild.

To crown and stem rust: CS= completely susceptible; S= susceptible; I= intermediate; R= resistant; HR= highly resistant.

In the Gainesville tests, these new varieties were grown in two separated nurseries with two replicates in each nursery. An epiphytotic of crown rust was maintained in one nursery and stem rust in the other. The forage potential of these varieties was estimated in both nurseries.

The soil-borne viruses Marmor terrestre var. typicum McK. and M. terrestre var. oculatum McK. are capable of causing considerable losses to oats grown in North Carolina and neighboring States. The nursery in North Carolina was sown in a plot known to be infested with the soil-borne viruses. Most of the 86 new introductions were so severely attacked by the

[1] We wish to express our appreciation to Dave Ward of The Division of Cereal Crops and Diseases for furnishing the seed for these tests.

viruses that they failed to head, but a few were highly resistant, and also appeared to be adapted to the local conditions. The weather was very mild during the winter of 1952-53, and very few oat varieties or selections showed winter injury.

Some of these new introductions may be sources of resistance to the crown and stem rust races prevalent in Southeastern United States. Since most of the varieties now being used for resistance to these two rusts are susceptible to mosaic[2], these new introductions combining resistance to rusts and mosaic may alleviate the work of the plant breeders in areas where mosaic is a problem.

U. S. BUREAU OF PLANT INDUSTRY, SOIL, AND AGRICULTURAL ENGINEERING, DIVISION OF CEREAL CROPS AND DISEASES, IN COOPERATION WITH THE FLORIDA AND NORTH CAROLINA AGRICULTURAL EXPERIMENT STATIONS.

2 Moseman, J. G., et al. 1953. Reaction of winter oat varieties and selections to soil-borne viruses in Southeastern United States. Plant Dis. Reptr. 37: 226-228. 1953.

DAMAGE CAUSED BY MEADOW NEMATODES TO CORN IN EAST TEXAS[1]

P. A. Young

A large spot in a field with corn stalks only 6 to 36 inches tall, surrounded or bordered by normal stalks 60 to 80 inches tall, indicates damage by meadow nematodes (Figure 1.) The dwarfed stalks are easy to pull. Most of their roots are only 1/4 to 3 inches long, with enlarged or fasciated ends. Many of the roots show brown spots or ends. Species of meadow nematodes (Pratylenchus) were identified in such roots by Dr. G. Steiner of the U. S. Department of Agriculture (3).

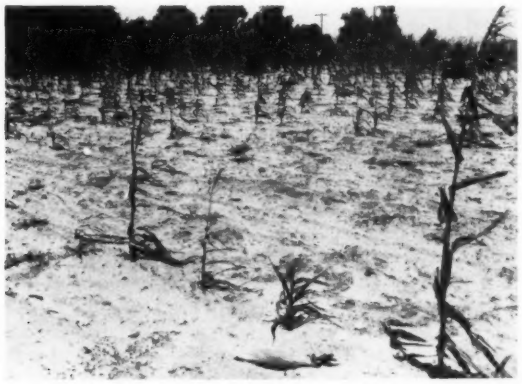

FIGURE 1. Hybrid 12 corn dwarfed by meadow nematodes at the Tomato Disease Laboratory, Jacksonville, Texas, July 27, 1944.

Corn with these symptoms of injury by meadow nematodes was found in two sandy fields of the Tomato Disease Laboratory in 1942 and 1944. In both cases, the corn emerged early in April and its growth was delayed by excessive cold rainwater that ran down the planter furrows and sand-barred the corn seedlings. The seedlings became slightly chlorotic when their roots remained in cold wet soil for several days before cultivation aerated the soil. This environment apparently favored rapid multiplication of the nematodes and infestation of the roots.

These nematodes migrate in the soil and penetrate the cortex of the roots. Groups of nematodes often girdle and amputate the roots, and produce brown lesions in the sides and tips of the roots. Amputated roots may produce many branches (3).

Besides the direct injury by the nematodes, the wounds that they make in roots permit entry of parasitic fungi and bacteria that may increase the damage. The severe injury to the roots often results in dwarfing and early dying of the plants. Meadow nematodes also damage the appearance and market quality of root crops.

Examination of affected roots may fail to disclose the nematodes since they leave decaying roots. Sometimes meadow nematodes may be found in soil near roots. The nematodes may be abundant in cool wet soil but rare in hot dry soil. Hence, disease incited by meadow nematodes and other free-living nematodes may be diagnosed incorrectly as due to weather injury or to fungi.

This belated report is prepared now because of the recently increased realization that parasitic free-living nematodes are common and destructive. Corn was dwarfed by Pratylenchus zeae in spots of fields near Yoakum (2). Rose roots fasciated by meadow nematodes were found near Tyler in 1951. Boxwood roots fasciated by Pratylenchus pratensis were found in 1939 (1).

Early cultivation to aerate cold wet soil around the roots of corn seedlings probably will minimize damage from meadow nematodes.

Literature Cited

1. Godfrey, G. H. and P. A. Young. 1943. Soil fumigation for plant disease control.

[1] Texas Agricultural Experiment Station Technical Article No. 1822

Texas Agr. Exp. Station. Bul. 628.

2. Harrison, A. L. 1952. Plant disease notes from Texas. Plant Dis. Reptr. 36: 491.
3. Steiner, G. 1945. Meadow nematodes as the cause of root destruction. Phytopath. 35: 935-937. (Fig. 1 shows fasciated corn roots from Jacksonville, Texas.in 1942.)
4. Young, P. A. 1951. Corn plants stunted by nematodes. Crops and Soils, p. 29, June-July.

TEXAS AGRICULTURAL EXPERIMENT STATION, JACKSONVILLE, TEXAS.

APPLE POWDERY MILDEW SPRAY TRIALS, 1953

Roderick Sprague

This is the fifth year that the present series of spray trials has been in progress at Wenatchee, Washington. A stationary spray outfit using 600 lbs. pressure with one spray gun is used. Each treatment is replicated five, or occasionally four, times. The trees are 11-year-old Black Jonathan except for a few older standard Jonathan. The first spray was applied April 1 at pre-pink; the second at pink, April 15-16; a third at calyx, April 30-May 2; a first cover on May 15 and a second one on May 28. Powdery mildew (Podosphaera leucotricha) was prevalent this season not only in the susceptible Black and standard Jonathans, Romes and Golden Delicious, but sometimes in the resistant Delicious and Winesaps.

This is the first year since 1948 that there has been any appreciable mildew etching on Jonathan fruit. Usually most mildew injury has been on the leaves. It has also been the first year that pre-pink sprays have shown any value since 1948. The season opened early, but became cold after April 1. Mildew developed steadily during April and by calyx time was rampant. Overwintering of the fungus in the buds was heavy, infection averaging over 40 percent in March.

Since the standard Jonathans have not always been profitable, they are frequently neglected, many growers retaining them for pollinators only. Mildew has now spread to more profitable varieties. The growers are faced with the problem of control or elimination of these trees. Since one of the profitable varieties, Golden Delicious, is becoming seriously affected, it is likely that wider attention will be given to control measures in 1954.

Our results, in part, for 1953 are briefly summarized in the table appended. Actual percentage of leaf terminal injury was recorded on April 14 and at seven other times during the season. Since it is well known that percentage of terminals infected is not the whole story injury was calculated somewhat more closely at harvest time, September 16, as follows: heavy surface injury, 100 percent coverage, class 1; moderately heavy surface injury, 80 percent, class 2; moderate injury, 60 percent, class 3; moderately light, 40 percent, class 4; light, 20 percent leaf coverage, class 5. After counting the percentage of leaves infected, the entire block of 120 trees was classified as to severity of leaf coverage (1 to 5). The percentage of leaves infected is then divided by the factor (1 to 5) to give the calculated loss. Thus, if 70 percent of the leaves are infected and the factor is 1 (heavy, 100 percent coverage), the loss is calculated as 70 ÷ 1 or 70 percent. If the factor was 3 (moderate mildew coverage, 60 percent), the calculated loss would be 70 ÷ 3 or 23.3 percent. This somewhat crude method is open to criticism, of course, but it is a step toward a more critical analysis of spray results.

In studying the tabular data, cognizance should be taken of the amount of overwintered mildew present in a block. In our plots it varied appreciably. For instance, the Karathane treatment had 48.8 percent of the buds infected before sprays were applied while the lime-sulfur and wettable sulfur schedule started with only 17.9 percent.

Relatively effective sprays included Polysulfide Compound, lime-sulfur, and Karathane. Timing indicated that pink, calyx, and cover sprays were necessary, and a pre-pink about two weeks before the pink spray was useful in 1953. There was much less mildew etching on the fruit of sprayed trees than in the unsprayed checks, and of course the leaves of the unsprayed checks were virtually destroyed by harvest time.

Because of the very heavy predicted carryover, we feel that spraying should start early next year:

On Jonathans and Romes

1. Pre-pink (if mildew shows early) Polysulfide Compound, 4 lbs. per 100 gals. (conventional) or lime-sulfur, 3 gals. per 100 gals.
2. Pink, Polysulfide Compound, 3.5 lbs.; lime-sulfur, 3 gals.
3. Calyx (petal fall), Polysulfide Compound, 3 lbs.; lime-sulfur, 2.5 gals.
4. Cover (14-17 days after calyx), wettable sulfur, 3 lbs.

Table 1. Summary of apple powdery mildew spray trials, 1953, at Tree Fruit Experiment Station, Wenatchee, Washington.

Treatment (lbs. per 100 gals. water)	Percent mildew on April 14	Calculated percent loss on Sept. 16
Polysulfide (1)[a] 4lbs.; (2) 3 lbs.; (3) 2.5 lbs.	19.3	9.4
Polysulfide (1) 4 lbs.; (2) 3 lbs.; (3 and 4) 2.5 lbs.; and Sulforon (5) 3 lbs.	25.7	8.0
Lime-sulfur (2) 2.5%; (3) 2%; Sulforon (4) 3 lbs.	17.9	11.0
Polysulfide bloom spray 2.5 lbs.	34.3	11.4
Polysulfide (2, double sprayed, on succeeding days) 3.5 lbs. and 3 lbs.; (3) 2.5 lbs.	28.8	13.1
Karathane (1, 2, 3, 4, 5) 1 lb.	48.8	13.9
Phygon XL (1) 1 lb.; (2) 3/4 lb; (3) 1/2 lb.; (4) 1 lb.	30.5	14.2
Colsul (2, 3, 4, 5) 3 lbs.	45.0	14.4
Polysulfide bloom spray 2.5 lbs.; (4) Sulforon 3 lbs.	32.8	14.8
Polysulfide (2) 4 lbs.; (3) 2.5 lbs.; (4) Colsul 3 lbs.	45.3	15.8
Polysulfide (2) 3 lbs.; (3) 2.5 lbs.; (4, 5) Sulforon 3 lbs.; Z-1 in (5)	34.8	18.4
Polysulfide (2) 3 lbs.; (3) 2.5 lbs.; (4) 2.5 lbs.	53.9	19.3
Polysulfide plus DDT (2) 3 + 2 lbs.; (3) 2.5 + 1.5 lbs.	52.4	17.5
Polysulfide plus parathion (2) 3 + 1 lbs.; (3) 2.5 + 1 lb.	42.9	20.9
Rohm & Haas 737 (2) 2 lbs.; (3) 2 1/4 lbs. (4) 2 1/4 lbs.	49.7	23.1
Polysulfide (squirrel ear) 4 lbs.; (2) 3 lbs.; (4) 2.5 lbs.	45.8	26.4
Polysulfide (2) 3 lbs.; (3) 2.5 lbs.	53.9	36.5
Captan (2, 3) 3 lbs.	46.0	34.4
Captan + parathion (2, 3) 2 + 1 lbs.	40.1	35.5
Ovotran (2) 10 oz.; (3) 1 lb.	42.6	55.6
Unsprayed checks	41.4	56.8

[a](1) pre-pink; (2) pink; (3) calyx; (4) 1st cover; (5) 2nd cover.

On Goldens

Same as above but omit calyx and cover sprays.

On Winesaps (or mixed orchards)

Dust with sulfur, 50 lbs. per acre, at pre-pink and pink.

On Delicious (standard and red strains)

In cooler valleys where lime-sulfur is used for scab control, mildew will be checked by scab sprays. Otherwise, use caution in applying lime-sulfur on Delicious. Use 2 gals. of lime-sulfur or 1 gal. lime sulfur plus 2 lbs. wettable sulfur at pre-pink and pink.

Karathane, which is not available commerically under that name, again showed considerable promise. It was one of the few sprays that actually gained on the mildew. The trees sprayed with this material were severely mildewed in 1952, and the odds against control were heavy. Captan, on the other hand, has only a mild depressing effect on mildew even at 3 lbs. per 100 gallons. The miticide, Ovotran, has no effect. Phygon was effective at the 1-lb. rate which makes it costly. The colloidal sulfur, Colsul, made in New Zealand, looked promising at the 3-lb. rate, but a representative of the firm who saw the trials was amazed at how difficult it is to control mildew in our area. Probably this material could stand a 4-lb. rate. The material is very detergent and a sticker is needed.

In addition to the trials on mature trees, tests were run on smaller three-year-old closely planted nursery stock of Black Jonathan and other varieties. The following materials at the indicated amounts per 100 gallons of water proved unsatisfactory: merculine, 1/2 pt. per 100 gallons; same material at 1 pt.; cuprosal, 1 qt.; mercusan, 1qt.; fermuline, 1 pt.; bis (chlorophenyl) iodonium chloride (Battelle Inst.) 1 lb. (insoluble and almost nonemulsifiable); Penn. Salt NP 770 E 30, 2 qts.; bis (acetamidophenyl) iodonium chloride, 0.3 lbs.; Rohm and Haas 765, 2 lbs.; Penn. Salt NP 1083 W-25, 2 lbs.; lithium chloride, 3 lbs.; lithium sulfate, 3 lbs.; lithium chloride, 2 lbs. plus potassium chlorate, 2 lbs.; lithium sulfate, 2 lbs. plus potassium sulfate, 2 lbs. Phenamin special W.E., 2 pts. and Phenamin Technical W.E., 2 pts. showed some promise on small trees, but Phenamin Technical 2 lbs. per 100 gals. applied on 11-year-old trees August 22 had not shown any appreciable control by September 16. This material will be given further trials, however. Unsatisfactory materials used in our larger field trials but omitted from the data include Ethyl Corp. B 622 W. B. (no control); Stauffer N 244 (fair control); Crag 658 (poor); Penn. Salt 1409 W-50, Stauffer N 521, and streptomycin (sulfate) at 10 ppm.

The unabridged data will be filed in the station report.

TREE FRUIT EXPERIMENT STATION WENATCHEE, WASHINGTON

EFFECTS OF TERRAMYCIN ON PEACH TREES AFFECTED WITH BACTERIAL SPOT

John C. Dunegan[1], R. A. Wilson[2], and W. T. Morris[2]

In a brief note[3] it was reported that in 1952 the injection of 28.4 liters of a solution containing 1.7 grams of terramycin[4] into an Elberta peach tree caused the leaves to develop a yellow green color. In addition the defoliation due to Xanthomonas pruni, the bacterial spot organism, was markedly reduced.

Because these results, observed following the treatment of only two trees, might well reflect individual tree variations, additional trees were treated in 1953. In this second injection experiment three trees each of the varieties Sunhigh, Rio Oso Gem, and Valiant were treated at Beltsville, Maryland.

In making the injections two 5/8-inch holes were bored at right angles through the trunk of each tree approximately mid-way between the soil line and the crotch. After the debris was cleared from the holes, number "0" rubber stoppers, with 1/4-inch glass tubes through their centers were inserted. The normal flare of the stopper insured a leakproof fit. The four tubes from each tree were connected to an elevated reservoir containing terramycin solution (100 ppm). Air was eliminated from the system through the use of glass "T" connections as "bleeders". This injection procedure is merely an adaptation of the methods described by Roach[5] in 1938.

The injections were started at 9 a.m. on April 23. It was planned to inject one tree of each variety with 2.4 grams of terramycin in 20 liters of water and a second tree with 4.8 grams of terramycin in 40 liters of water. The third tree was to receive 40 liters of water as a control. However, the uptake of the terramycin solution was very slow in comparison with the uptake of water in the control tree and finally stopped before even 10 liters of terramycin solution were used. The first Sunhigh tree absorbed 7.5 liters containing 0.9 gram of terramycin and the second only 7.9 liters containing 0.95 gram of terramycin. The control tree absorbed 40 liters of water. Similarly the Rio Oso Gem and Valiant trees absorbed 0.75, 0.94, 0.72 and 0.96 gram of terramycin, respectively.

After five days the leaves on all the trees that received terramycin developed a yellowish cast and could be distinguished readily from those on the control trees. This difference in color persisted for approximately 60 days.

In 1952 the trees had been injected in June and subsequently inoculated with Xanthomonas pruni. In 1953 the injections were started at the beginning of the season and the trees were purposely not inoculated in order to determine whether the treatments affected the natural development of bacterial spot as the season advanced. The trees were examined from time to time during April and May and by June 1 it was evident that the disease was present to varying degrees on all.

The figures in Table 1, based on the examination of all the leaves dropping during the period June 10 to July 1, 1953, show that more leaves dropped from the control trees than from the trees injected with terramycin. Many of the leaves that dropped from the treated trees showed no bacterial spot symptoms but the bacterial spot organism was responsible for most of the defoliation of the control trees, for 95, 88, and 73 percent, respectively, of the leaves showed typical bacterial spot symptoms. Moreover, the effects of the injection of terramycin were not limited to the leaves. When the fruit was examined at harvest it was found (Table 1) that there was less bacterial spot on the terramycin-treated trees.

It is well known that the incidence of bacterial spot on both leaves and fruit varies widely from tree to tree. The results of these small-scale experiments must therefore be accepted

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[3] Duegan, John C., and R. A. Wilson. Some Effects Resulting from the Introduction of Antibiotics into Fruit Trees (Abstract). Phytopathology 43, 405. 1953.

[4] The terramycin used in the experiments in 1952 and 1953 was supplied gratuitously by the Chas. Pfizer Co., Brooklyn, New York.

[5] Roach, W. A. Plant Injection for Diagnostic and Curative Purposes. Imp. Bur. Horticulture and Plantation Crops Tech. Comm. No. 10, illus. 1938.

Table 1. Leaf drop and bacterial spot of terramycin-treated and untreated peach trees, 1953.

Variety	Treatment	Leaves on ground (June 10 to July 1, 1953)			Percent of fruit with bacterial spot
		Total Number	Number with bacterial spot	Percent with bacterial spot	
Sunhigh	Terramycin	2524	925	37	26
	Terramycin	1983	1376	69	35
	Control	8507	8124	95	85
Rio Oso Gem	Terramycin	573	176	31	22
	Terramycin	546	97	18	3
	Control	2699	2382	88	55
Valiant	Terramycin	788	78	10	2
	Terramycin	1010	125	12	0.5
	Control	2504	1828	73	11

with caution and should be confirmed by more extensive experiments before it can be stated that terramycin will control bacterial spot.

It is clear, however, from the yellow green color that developed in 1952 and 1953 on trees injected with terramycin solution that this material, or some degradation product from it, can be translocated throughout bearing peach trees.

Likewise the introduction of terramycin in some manner retards defoliation. This effect may be due solely to a reduction in the number of bacterial spot infections. It may, on the other hand, be the result of some antidoting effect that prevents toxins produced by the organism from stimulating the formation of an absciss layer. These questions remain to be answered.

Finally the results of the two years' experiments show clearly that the effect of the terramycin persists throughout the season, for at the end of the season the treated trees still had many more leaves than the control tree.

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A LATENT VIRUS OF FRAGARIA VESCA

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Since 1949 a runnerless variety of Alpine strawberry, Fragaria vesca L., propagated by seed, has been used by the author as a standard virus indicator plant in the isolation and study of strawberry viruses. When viruses considered to be discrete and producing consistent symptoms in seedling Alpine plants were transmitted into clonal selections of F. vesca (East Malling clone) and F. bracteata Heller, two types of symptoms resulted: 1), a mild type relatively characteristic of the disease in the Alpine variety and, 2), a more severe type. On seedling plants or plants of clones established from selected seedlings only the mild symptom type resulted.

It became evident that the type of reaction could be related to selected lines that had been propagated as clones. Visual comparison failed to indicate any characters by which the clones giving the more severe type of symptoms (S clones) could with certainty be distinguished from other clones giving the mild symptoms (M clones). It was hypothesized that the S clones might be carrying a latent virus not present in the M clones.

To test the hypothesis, grafting tests were carried out in which a stolon on two F. bracteata and two F. vesca (East Malling clone) S plants were each inarched to a stolon on a plant of an M clone propagated from a vesca-type seedling selection. In addition, one F. vesca (East Malling clone) S and M plant was inarched together. At the same time, a non-grafted sister plant of each of the two M clones was set aside for runner development. After a period of two months, daughter plants were propagated from all of the 12 test plants, and as soon as they had become independently established were subjected to infection with six undetermined viruses or virus strains by means of five strawberry aphids, Capitophorus fragaefollii (Ckll.), per plant.

The aphids transmitted virus to every plant. All non-grafted M plants developed mild symptoms similar to the expression characteristic for each virus in the Alpine variety. All grafted plants developed a more severe type of symptom reaction to each virus. From the above results, it is evident that the factor in the S clones is transmissible by grafting and is carried through the stolon from mother to daughter plants. It is concluded that a latent virus is present in the S clones and is designated here as "strawberry latent virus".

In no case has it been possible to discern reliable symptoms in S clones of any of four vesca-type indicator varieties (F. bracteata, F. vesca (East Malling clone), a seedling of a woodland strawberry of Southern California, and a seedling of F. vesca (East Malling clone)). It sometimes seems that infected plants are slightly less vigorous than virus-free plants with perhaps a tendency in the East Malling plants for very faint diffuse chlorotic spots or areas in the leaves.

The effect of the latent virus is to cause a more severe disease in combination with a second virus than would be caused by the second virus alone. In the few tests thus far attempted, the effect has been pronounced in combination with viruses or virus strains similar to strawberry mottle (1).

In non-carrying F. vesca (East Malling clone), one of the milder mottle viruses or virus strains causes only slight stunting, very mild vein clearing and chlorotic mottle on immature leaves, diffuse faint mottle on older leaves, with little tendency for leaf deformation or raised green blisters (Fig. 1, above). In F. vesca (East Malling clone) carrying latent virus, the same mottle virus often causes an initial shock reaction during which immature leaves exhibit marked yellow vein clearing, frequently a downward crooking of the petiole and partial or complete necrosis of leaflets. Later, affected plants show definite reduction in size, a greater than normal crown proliferation, petioles frequently curved and twisted, lamina moderately deformed, crinkled and blistered with diffuse mottle, finely cleared and often merged veins, and characteristic chlorotic spots appearing like scar-tissue scattered over the lamina and along the margins where they cause malformation (Fig. 1, below). In combination with other mottle viruses or strains, the symptoms may be more severe.

The latent virus carried in F. bracteata is similar to that carried in F. vesca. The symptoms of the latent virus whether from bracteata or vesca when combined with a common virus in a common host appear to be of the same type, but differ consistently in that the virus in bracteata causes a distinctly more severe disease. It is thought, on the basis of the present information, that the two may be considered to be strains of the same virus. The virus from F. vesca (East Malling clone) is therefore designated as strain A, and that from F. bracteata as strain B of the strawberry latent virus.

The author has little information concerning the virus, its origin or distribution. The

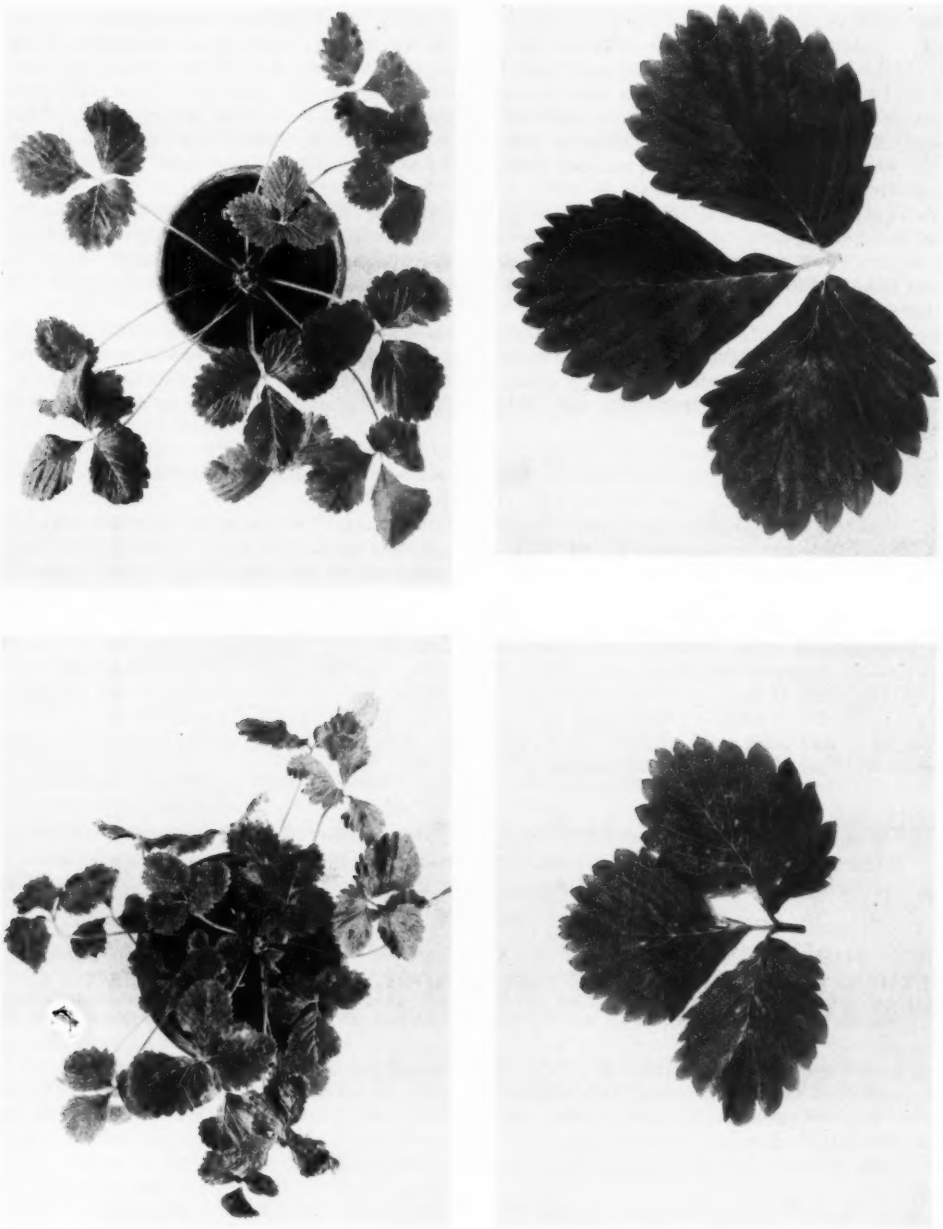

FIGURE 1. Symptoms in Fragaria vesca (East Malling clone), above, of a mild strawberry mottle type virus alone, and, below, in combination with strawberry latent virus strain A. The leaves on the right were taken from the plants on the left.

virus has been transmitted only by grafting. Initial attempts to transmit the virus by means of several species of aphids, including the strawberry aphid, have yielded only negative results to date. There is no evidence to indicate that natural spread has ever occurred in the greenhouse, although such spread might easily not have been detected. Likewise, there is no evidence that the latent virus has ever been transmitted during vector tests with other strawberry viruses in those known instances in which the inoculum plant also carried latent virus. The F. bracteata stock was originally obtained in the wild in Sonoma and Santa Cruz Counties in California. The evidence would indicate that some of the original plants from both localities were naturally infected when collected.

Two plants of the East Malling clone of F. vesca were received from each of two sources in 1949 and propagated, and, from one of the same sources, some additional plants were secured during 1951, only one of which was selected for propagation. All four plants received in 1949 carried latent virus, but the single plant propagated from those received during 1951 was virus-free.

It is not known, of course, how widespread the use of the contaminated stock of F. vesca (East Malling clone) might be, or to what extent its use may have influenced the symptom descriptions in the literature of strawberry viruses in F. vesca. It is certain that the use of indicator plants carrying the latent virus may very greatly influence the results of strawberry virus investigations.

Summary

A virus, termed strawberry latent virus, has been found to occur in the East Malling clone of Fragaria vesca and in plants of F. bracteata originating in California.

The virus does not appear to cause definitive symptoms in strawberry by itself, but in combination with a second virus a more severe disease results than would be caused by either virus alone.

In combination with other viruses, the latent virus from F. bracteata consistently causes a more severe disease than latent virus from F. vesca. On the basis of this difference, a strain relationship is thought to be indicated. The virus from F. vesca is therefore designated as strain A, and that from F. bracteata as strain B, of the strawberry latent virus.

The virus has been transmitted only by grafting. The distribution of the virus in indicator or commercial strawberries is not known.

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EFFECT OF HOT-WATER TREATMENT ON VIRUS-INFECTED STRAWBERRY PLANTS AND VIRUSES[1]

P. W. Miller

Heat therapy for the cure of virus diseases of plants has been investigated by a number of workers. Wilbrink (9) was among the first to try heat therapy for the control of a virus disease. He reported in 1923 that the sereh virus of sugar cane could be inactivated without injury to the host by immersing sugar cane pieces in water at 52° C. for 30 to 60 minutes.

In 1935, Kunkel (5) reported the cure of peach trees infected with the yellows and the rosette viruses by holding them in a hot room at 34.4° C. to 36.3° for 2 weeks or longer. The following year, the same investigator (6) reported complete inactivation of the yellows virus in year-old peach trees with soil removed from their roots by immersion in hot water for 4 minutes at 50°, for 1 minute at 52°, and for 15 seconds at 56°. Yellows-infected buds were cured by hot-water treatment for 25 minutes at 45° and for 4 minutes or longer at 50° and above. The virus in peach buds infected with rosette was also completely inactivated by holding in hot water for 10 minutes at 50°.

Hutchins and Rue (4) were able to inactivate the phony-peach virus by immersing two-year-old infected trees in hot water for 40 minutes or longer at 48° C. The treated trees remained healthy for 20 months and were considered cured.

In 1941 Hildebrand (3) reported the inactivation of the "X", or yellow-red, virus of peach trees by immersing infected bud sticks for 5 minutes or more in a hot-water bath at 50° C.

Kunkel (7) was unable to inactivate the yellows virus in asters without serious injury to the plants, but when the aster yellows virus was transmitted to periwinkle (Vinca rosea) by infected leafhoppers he was able to inactivate the virus by holding the infected plants in rooms at 38° and 42° C. for 2 weeks. Infected periwinkles were also cured by a 3-hour immersion in hot water at 45°, but they showed some injury from which they later recovered. Kunkel found most herbaceous plants too sensitive to such heat treatments, but Nicotiana rustica was freed without serious injury from the aster yellows virus by dry heat treatment for 3 weeks at 40°. Similar attempts with infected lettuce plants failed because of severe injury to the host.

Fulton (2), the first investigator to report on attempts to inactivate strawberry viruses by hot-water treatment, was unable to inactivate the "type 2" virus of Demaree and Marcus (1) in the Robinson strawberry by immersing infected plants in hot water at 45° C. for 30 minutes. In 1953, Posnette (8) reported that the mild crinkle virus (virus 1), the crinkle virus (virus 3), and an undescribed virus causing severe leaf necrosis on Royal Sovereign strawberry were inactivated when subjected to dry heat at 37° for 8 days.

Experiments on the inactivation of strawberry viruses by heat treatment were initiated by the writer in 1950 and have been carried on sporadically to date. A report of the experiments carried on and the results obtained follows.

Methods

At various times during the year, bare-rooted strawberry plants known to be infected with viruses were immersed for various periods (Table 1) in a hot-water bath stirred by a motor-driven agitator to maintain the same temperature in all parts of the bath which was maintained at + 1°F. of each temperature under test. The plants were suspended individually in small, coarse-wire baskets in the center of the bath.

Approximately three-fourths of the plants treated were Marshall; the remainder were Northwest, Brightmore, and Redrich varieties. Most of the Marshall plants showed definite virus symptoms when treated, but the Northwest, Brightmore, and Redrich varieties, being more or less virus-tolerant, did not show disease symptoms; however, all plants treated had been previously shown to be viruliferous as indicated by positive virus symptoms on Fragaria vesca indicator plants to which they were grafted.

Immediately after treatment, the treated plants were potted in sterile soil and incubated at room temperature. One to two months later, the plants which were still alive were tested for the presence of viruses by the aphid-transmission technique, using virus-sensitive F. vesca (East Malling strain) indicator plants.

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[1]Approved for publication as Technical Paper No. 814 by the Director of the Oregon Agricultural Experiment Station and by the Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture. Contribution of the Department of Botany and Plant Pathology of the Oregon Agricultural Experiment Station and of Division of Fruit and Nut Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering.

Table 1. Effect of hot water treatment for various periods on strawberry plants and viruses: Corvallis, Oregon: 1950 - 1953.

Approximate temperature[a] and duration of treatment		Number plants treated	Number plants surviving	
			Virus-free	Infected[b]
°F	Hours			
109°	1/2	11	3	5
	3/4	8	0	3
	1	14	2	12
	2	10	0	6
	3	7	0	6
	4	7	4	0
	5	8	0	0
	6	6	0	2
	7	14	2	0
	8	6	0	0
110°	1/2	8	0	7
	3/4	6	0	6
	1	11	1	8
	2	25	5	10
	3	5	0	4
	4	10	2	5
	5	11	0	3
	6	13	1	4
	7	12	0	0
	8	5	0	4
111°	1/2	6	1	4
	3/4	5	0	2
	1	11	0	11
	2	12	0	9
	3	8	1	2
	4	10	0	0
	5	8	0	0
	6	7	0	0
112°	1/2	7	1	5
	3/4	8	0	7
	1	11	0	4
	2	10	0	6
	3	12	1	6
	4	10	0	6
	5	8	0	0
	6	8	0	0
113°	1/2	5	0	3
	3/4	12	1	7
	1	14	1	11
	2	8	0	4
	3	7	0	2
	4	10	1	3
	5	8	1	0
	6	10	0	0
114°	1/2	14	3	11
	3/4	10	0	6
	1	18	4	4
	2	13	0	2
	3	22	0	4
	4	13	0	1
	5	10	1	1
	6	9	0	0
115°	1/2	20	3	13
	3/4	14	1	11
	1	22	1	4
	2	8	0	2
	3	9	0	1
	4	5	0	0
116°	1/2	9	2	7
	3/4	11	0	6
	1	39	1	5
	2	20	0	2
	3	4	0	1
	4	5	0	0
	5	3	0	0
117°	1/2	20	2	13
	3/4	12	0	8
	1	30	0	3
	2	12	0	0
	3	5	0	1
	4	4	0	0
118°	1/2	17	3	7
	3/4	12	1	4
	1	24	0	2
	2	7	0	0
	3	7	0	2
	4	6	0	0
119°	1/2	13	2	3
	3/4	7	0	5
	1	14	2	1
	2	11	0	0
	3	4	0	0
	4	5	0	0
	5	5	0	0
120°	1/2	17	2	2
	3/4	16	1	0
	1	22	0	0
	2	6	0	0
	3	5	0	0
	4	4	0	0
121°	1/2	15	0	2
	3/4	10	0	0
	1	12	0	0
	2	5	0	0
122°	1/2	10	0	0
	3/4	11	0	0
	1	12	0	0
	2	9	0	0
123°	1/2	9	0	0
	3/4	4	0	0
	1	8	0	0
	2	9	0	3
	3	7	0	0
124°	1/2	15	0	0
	3/4	7	0	0
	1	11	0	0
	2	7	0	0
Totals		1,136	57	314

[a] The temperature was ± 1° of that indicated.

[b] Presence of viruses determined by transmission with aphids to healthy virus-sensitive Fragaria vesca (East Malling strain) plants.

Discussion of Results

The results given in Table 1 would appear to indicate that the components of the strawberry virus complex are in general relatively highly thermostable. However, limited virus inactivation appears to have occurred at various temperatures for certain periods. The temperatures and times at which inactivation occurred were as follows: 109°F. for 1/2, 1, 4, and 7 hours; 110° for 1, 2, 4, and 6 hours; 111° for 1/2 and 3 hours; 112° for 1/2 and 3 hours; 113° for 3/4, 1, 4, and 5 hours; 114° for 1/2, 1, and 5 hours; 115° for 1/2, 3/4, and 1 hour; 116° for 1/2 and 1 hour; 117° for 1/2 hour; 118° for 1/2 and 3/4 hour; 119° for 1/2 and 1 hour; 120° for 1/2 and 3/4 hour, respectively.

As shown in Table 1, 57 treated plants had the viruses inactivated by hot water. Of these, 31 plants later succumbed to the ill effects of the heat treatment. All 26 of those still alive were apparently still free of virus infection four to eight months after they were heat-treated.

There are certain inconsistencies in both the plant-survival and virus-inactivation data in Table 1 which are difficult to explain. For instance, all infected plants treated for 1/2, 3/4, and 1 hour, respectively, at 123°F. were killed, but after a 2-hour exposure at the same temperature, 3 of 9 plants so treated survived and the viruses were still alive in all of them. It is possible that the inconsistency in virus inactivation may be due to the presence in the different plants of different components or mixtures thereof which have different thermal death points.

The Redrich and the Brightmore generally withstood higher temperatures than the Marshall or the Northwest.

Dormant plants usually withstood higher temperatures for longer periods than vigorously growing ones.

The fatality of the heat-treated plants was very high, as shown by the fact that of 1,136 plants subjected to hot-water treatment 796 died as the result of treatment -- a fatality rate of 70 percent. This high fatality rate would rule against the commercial use of this method of control at the temperatures used. However, hot-water treatment may prove a possible means of obtaining disease-free clones of certain varieties that are now 100 percent infected.

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A NEW LEAFHOPPER-BORNE PLANT DISEASE FROM WESTERN EUROPE

Karl Maramorosch[1]

Our present knowledge of leafhoppers as vectors of plant viruses is based mainly on viruses that attack cultivated plants. In recent years efforts of several workers were directed towards a new approach of the problem of interrelationships of leafhoppers and plant viruses from a purely scientific point of view (2). Plausible sources of "new" plant viruses lie in the numerous leafhopper species that are symptomless vectors and can often support the multiplication of the viruses they transmit. The more widespread dissemination of viruses that have existed in this insect reservoir for many generations as more or less localized entities may result in a more widespread dissemination of plant-pathogenic viruses. An intensive study of viruses that are harbored by leafhoppers and that have the potentiality to infect plants may yield much basic information on this subject.

Until recently Western Europe was the only part of the world in which no leafhopper-transmitted plant viruses had been reported. From symptomatology and general evidence (4) it seemed likely that at least four diseases there might be leafhopper-borne. These diseases are the following: A disease of cherry trees known under the name of "Eckelrade disease" in Holland (5) and under the name of "Pfeffinger disease" in Switzerland (3), hop-nettlehead and potato witch's broom in England, and raspberry (Rubus) stunt in several European countries[2].

During the summer of 1953 cherry orchards were visited near Maastricht in the southern part of the Netherlands, in the region where severe outbreaks of Eckelrade disease were reported in previous years. From observations by several workers it was known that spread of the disease was irregular and that a number of trees had escaped infection, although these healthy trees grew in close proximity to cherry trees with the disease. Since earlier tests of leafhopper species found on cherry trees had failed to reveal a vector, it seemed possible that a species not normally found on trees but able to feed on them in the absence of its proper food plant might be responsible for the virus transmission. This hypothesis led to the collection of various species of Cicadellid leafhoppers in the grass. Fairly large numbers of Euscelis plebejus ssp. plebejus (Fall.)[3] were obtained by sweeping with a net under the trees. The insects were tested in a greenhouse in Wageningen on a variety of host plants. Only 2 out of 15 of the leafhoppers survived more than two days on cherry seedlings and these eventually died on the tenth day. The seedlings remained in a greenhouse for further observation. On crimson clover (Trifolium incarnatum) plants the insects lived and deposited eggs from which nymphs hatched within two weeks. As a result of these greenhouse tests, a new virus disease of crimson clover was detected. After a minimal incubation period of five days at 65°F., 5 out of 16 clover plants on which 16 individual leafhoppers were caged, showed disease symptoms. From a second collection, 3 out of 10 insects induced the same symptoms. First disease signs were characterized by enlarged veins (Fig. 1 A) and deep ridges on the upper surfaces of leaflets. The vein symptoms were somewhat reminiscent of the wound-tumor disease (1). Pronounced enations were noted on the lower surfaces of leaflets (Fig. 1 B). Later symptoms were chlorosis, which progressed from the outer edges towards the midribs of leaflets, and small malformed leaves on shortened petioles (Fig. 2).

The preliminary experiments have shown that E. plebejus harbored a virus which caused a previously unknown clover disease. A search in the orchard where the leafhoppers were collected failed to reveal diseased clover plants. It is hoped that further work will give more information on the virus-host relationship and on the host range of the virus and its possible connection with the causative agent of the Eckelrade disease.

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[1] The Laboratories of the Rockefeller Institute for Medical Research, New York, New York. The investigation, supported in part by a research grant from the Curators of the Agricultural University in Wageningen, Holland, was carried out at the Institute for Phytopathological Research in Wageningen. The author is indebted to Prof. T. H. Thung, Dr. J. G. ten Houten, Dr. H. J. de Fluiter, and their associates for providing facilities to carry out this investigation.

[2] Virus workers in Holland recently obtained evidence of its transmission by a leafhopper, Macropsis fuscula (Zett.) (personal communication).

[3] The author acknowledges with thanks the identification of the leafhopper by Dr. D. A. Young of the Division of Insect Detection and Identification, U. S. Department of Agriculture, Washington, D. C.

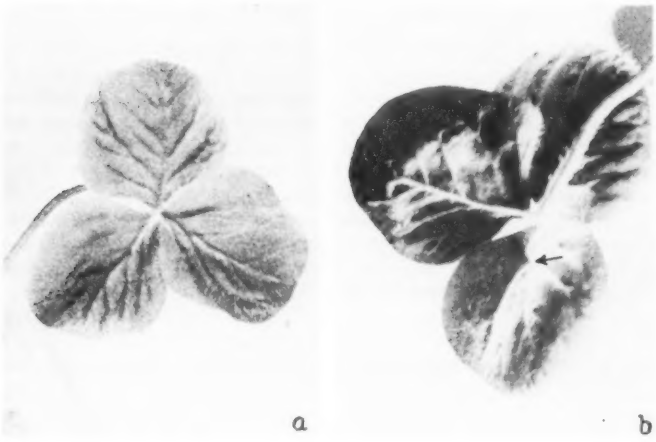

FIGURE 1 A. -- Upper surface of clover (Trifolium incarnatum) leaflet with deep ridges due to enlarged veins. B. -- Same leaflet from below; arrow points to a pronounced enation. Enlarged approximately 1 1/8 x.

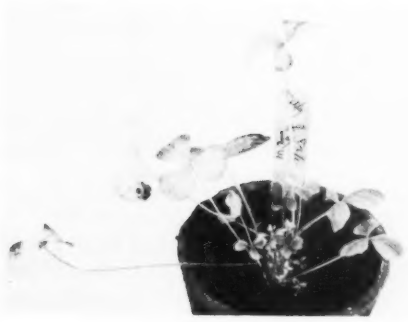

FIGURE 2. Advanced stage of the disease, showing younger small chlorotic leaves on short petioles.

(Photographs: Institute for Phytopathological Research, Wageningen.) (Inst. voor Plantenziektenkundig onderzoek).

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A SURVEY OF INTERNAL CORK OF SWEETPOTATOES IN MISISSIPPI IN 1952

L. J. Kushman and M. T. Deonier

Internal cork of sweetpotatoes is known to be widespread in most of the sweetpotato sections of the country. To indicate approximately how much internal cork may develop in commercial stocks in Mississippi during a warm storage season, 34 one-half-bushel samples were collected at random in 33 storage houses in the sweetpotato sections of Mississippi between October 29 and November 20, 1952, and held in a storage room at 70°F. until they were examined on January 26 and 27, 1953. It has been shown that the expression of internal cork in the sweetpotato root is promoted by storage temperatures of 70° or above (3, 4,5). The roots were examined by cutting them into slices about one-quarter inch thick.

The results obtained are summarized in Table 1:

Table 1. Distribution of internal cork in samples of 3 varieties of sweetpotatoes in Mississippi, 1952.

Variety	Number of samples examined	Number of samples containing indicated percentage of roots affected with internal cork						
		0	1-10	11-20	21-30	31-40	41-50	Over 50
Porto Rico[a]	30	5	12	3	1	1	3	5
Goldrush	2	0	2	0	0	0	0	0
Allgold	2	2[b]	0	0	0	0	0	0

[a]Includes all strains or selections sampled.
[b]Only questionable traces found.

Some internal cork was present in more than 80 percent of the Porto Rico stocks sampled and it was high in about one-fourth of them. The disease was found in all sections of the State sampled, but may be more severe in some than in others.

Goldrush has been reported to be susceptible and Allgold resistant to internal cork although Allgold may carry the virus without developing cork (1, 2). The data from the few samples of these varieties collected indicate that some commercial seed stocks of Goldrush in Mississippi are affected with internal cork, but that Allgold roots may be free of it. This is in agreement with other data collected by the authors.

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AN ATTEMPT TO INDUCE INTERNAL BROWNING OF TOMATOES IN THE FIELD[1]

Saul Rich

In the past five years, internal browning has become an important disease of tomatoes in Connecticut. The symptoms are a light silver gray discoloration on the surface of the fruit, often accompanied by small, brown, irregular pits. Cutting through the affected fruit reveals brown spots in the wall and core. The symptoms, which may be severe on one set of fruit and missing on the next, rarely appear in greenhouses. Plants showing symptoms in the field will produce clean fruit when brought into the greenhouse.

The disease has been attributed to improper water relations by P. A. Young (4) and recently by Raychaudhuri (2). Young described the disease as a variant of blossom-end rot. Raychaudhuri produced internal brown spots by giving large amounts of excess nitrogen to the plants, and then half submerging half-grown fruits, still attached to the plants, in dishes of water for five days.

Holmes (1) believes the disease to be virus initiated. Holmes has observed that the disease in New Jersey occurs only when there is virus-infected plantain within 16 feet of tomatoes. The virus was identified as the plantain strain of tobacco mosaic. He also observed that tomatoes resistant to tobacco mosaic remained free of the disease when growing in a field of commercial tomatoes which were badly damaged by internal browning. Holmes, however, has never been able to show a direct relationship by controlled transmission studies. Further, Raychaudhuri found that the fruit symptoms caused by excess nitrogen and dipping were independent of the presence of the plantain strain of tobacco mosaic.

In Florida, there is a disease called "gray-wall" which has fruit symptoms identical to those of internal browning (3). The Florida people, however, claim they have never found any evidence of virus associated with the disease.

The only clues from grower observations are 1) the disease is most prevalent where the vine growth has been most vigorous, and 2) the disease usually appears where tomato vines have been plowed into the ground the year before. Both of these observations have been subject to contradiction.

The experiment at Mt. Carmel this year was an attempt to induce the disease in the field. The primary factors tested were those suggested by Raychaudhuri's experiment: high humidity and excess nitrogen. Because the technique used to increase humidity also shaded the tomato fruits, shading was introduced as an interacting factor. In addition, various levels of nitrogen, phosphorus, and potassium were also tried, because Raychaudhuri's experiment indicated the possible importance of nutritional imbalance in initiating the disease.

It was hoped that if sufficient internal browning appeared in the plots, the plants could be tested for the plantain virus to check the correlation between this virus and the disease.

The field chosen for the experiment was one that had been inoculated with soil infested with the big-vein virus of lettuce. It was thought that big vein might be in some way associated with tomato internal-browning, because both diseases have become important in Connecticut within the past five years.

Materials and Methods

The Sioux variety was chosen for the test because of reports of considerable amounts of internal browning in this variety during 1952. The seed was furnished by the Associated Seed Company. Plants were started in the greenhouse on April 27, and set out in plant bands in a cold frame on June 4. The field plots were set up in a 13 x 4 Youden square, five plants to the plot, on June 19, when the plants were about 5 inches high. The plants were set out 2 feet apart, with 3 feet between plots and 4-foot aisles between rows. The soil had been adequately fertilized according to previous soil tests and recommendations of H. G. M. Jacobson. The plots received various combinations of extra nitrogen, phosphorus, and potassium on July 2, and again when the first flowers were set on July 14. These extra treatments were 1) ammonium nitrate at the rate of 40 pounds of nitrogen per acre, 2) superphos at 500 pounds per acre, and 3) 200 pounds per acre of muriate of potash. The fertilizer combinations are given in Table 1.

To induce water saturation around the fruit, polyethylene bags containing a water-soaked paper towel were tied around three hands of fruit in each plot on July 27, when the largest

[1]The author wishes to acknowledge the assistance of A. D. McDonnell.

Table 1. Extra fertilizer treatments for internal browning plots.

Plot	Treatment	Plot	Treatment
1	N	8	N + P
2	P	9	N + K
3	K	10	N + P + K
4	N + P	11	None
5	N + K	12	None
6	N	13	None
7	P		

Table 2. Temperatures and rainfall during nine day period that bags and foil were in place.

Date	Temperature (°F)		Rainfall (inches)
	Maximum	Minimum	
July 27	87	67	0
28	85	67	0
29	86	62	0
30	89	73	0
31	86	65	0
Aug. 1	79	55	0
2	66	53	Trace
3	76	52	.04
4	77	53	Trace

fruits were half grown. Each bag was placed on a different plant in each plot. In order to check the effect of shading, without water saturation, aluminum foil was placed over three hands of fruit on three different plants in each plot on the same day, July 27. The foil was bent over the sides of the fruit but remained open on the bottom. It was possible, therefore, to have one plant with both a bagged hand of fruit and one covered with foil, but no one plant had more than one bag or foil sheet. Treatments 11, 12, and 13 which received no extra fertilization were treated as follows: #11 had tied bags and foil, #12 had untied polyethylene bags with no water soaked toweling, and #13 had neither bags nor foil. The bags and foil were left on the plants until August 4, a period of nine days. The tied polyethylene bags appeared water soaked during that period as evidenced by condensation. The open bags on Treatment 12 and the foil had ample ventilation to prevent water saturation. The temperature within the tied polyethylene bags ran about 27°F. higher than the ambient temperature when the bags were in direct sunlight. All other enclosures maintained a temperature close to that of the surrounding air. These treatments caused very few dropped or rotted fruits. Table 2 gives the temperature and rainfall for the nine-day period during which the bags and foil were in place.

During the course of the experiment, a mosaic infection appeared on certain of the plants scattered through the plots. All plants were sprayed with Manzate, 2 lbs. per 100 gals., on August 10, 21, and 26 to slow down defoliation by early blight (Alternaria solani).

Results

Data were taken on September 9 by external and internal examination of all previously bagged and foiled fruits. In addition, three check hands of fruit were also examined from each plot. In all 1727 fruits were examined. Only three fruits showed definite internal browning. Two of these had been shaded under aluminum, and one was in an untreated check #13. Of the two under aluminum, one was in a plot which received extra phosphorus only, and one was in a plot which received extra potassium only.

Discussion

The results, although negative, are of value to show that the various combinations of fertilization, fruit shading, and water-saturation used here will not produce symptoms of internal browning in the field. It is possible that the various coverings were not left on the fruits for a period long enough to initiate the internal breakdown of the fruit.

The mosaic virus present in the plots was not identified[2], so that the Holmes virus theory cannot be discounted. Lettuce plants growing in the same field at the same time showed a high incidence of big-vein. These experiments show that the virus of lettuce big-vein is either not related to tomato internal browning, or is not in itself of primary importance in initiating the disease.

Summary

Various factors, singly and in combination, were tested in the field as possible initiators of internal browning of tomatoes. These factors were 1) different levels of nitrogen, phosphorus, and potassium, 2) high humidity around the fruit, 3) shading, 4) temperature, and 5) the virus causing big-vein of lettuce. As almost no internal browning appeared in the plots, it was concluded that these factors could not be of primary importance in inducing internal browning of tomatoes in the field.

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[2]There was only one plantain plant within 20 feet of the plots, and this plant showed no mottle.

A BOTRYTIS ROOTROT CONDITION IN LETTUCE

B. H. MacNeill

A rootrot condition in lettuce from the muck soils of the Bradford Marsh, Ontario, Canada, has been brought to our attention by growers who claim serious losses during the seasons of 1952 and 1953, in some instances amounting to more than 80 percent of their crop. An examination of affected plants reveals that both the tap root and the laterals are discoloured and show a progressive dying back from the tips. The tap root characteristically becomes deeply furrowed and coppery-green, and in extreme cases rots away entirely leaving only a stump (Figs. 1 and 2). Under moist conditions the proliferation of an abundance of adventitious roots from the hypocotyl region seems to prolong the life of the plant. On hot days moderately affected plants wilt and the wrapper leaves become loose. Plants that have been attacked early in the seedling stage, if they do not succumb and topple over, remain conspicuously small and fail to mature a marketable head.

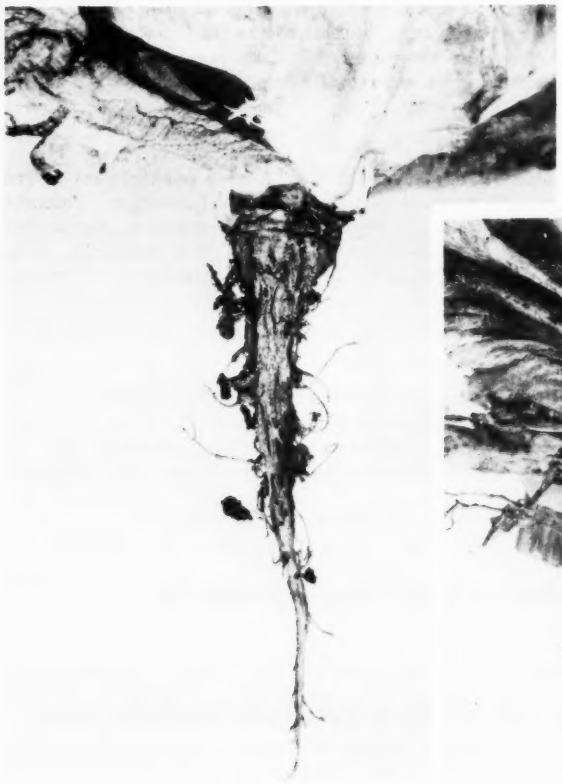

FIGURE 1. (left). Tap root of lettuce showing deep furrows and cracks resulting from Botrytis attack.

FIGURE 2. (right). Advanced stage of attack. Adventitious roots proliferate from hypocotyl region after main root has rotted away.

Isolations from the roots of diseased specimens have yielded a strain of Botrytis cinerea which is believed to be the agent responsible for the rootrot condition in the Bradford Marsh area. Unlike B. cinerea causing gray mold in lettuce, the Bradford strain appears to be confined to the underground parts of the plant; rarely is the fungus found on the leaves and then only after the plants have collapsed completely.

In pathogenicity tests upon lettuce seedlings transplanted to quartz sand into which cornmeal inoculum had been incorporated, the Bradford isolate has proven to be extremely aggressive. A multiple invasion of the hypocotyl and root takes place within 20 hours of exposure to the pathogen, and this is followed by the rapid collapse of the underground parts. A similar type of invasion takes place when the inoculum is added to non-steamed greenhouse soil, although the onset of disease is somewhat delayed. The capacity of the organism to attack the roots of more mature plants has not been demonstrated.

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TREATMENT OF VEGETABLE SEED FOR IMPROVED EMERGENCE[1]

V. R. Wallen[2]

In a previous paper (1) striking increases in emergence were obtained when vegetable seed of low germination was treated with a number of chemical seed dressings. The fact that seed, held in storage to the point where its germinative capacity is drastically reduced, can be materially improved by seed treatment, indicates that there has been little loss of viability during storage, but that a weakening of the seed has occurred which was offset by the use of fungicidal seed dressings. In a continuation of this work the present report deals with further tests of five of the materials previously tested as well as two additional fungicides. In the case of Merculine and Mercusol the dosage selected was experimental and too extreme in some cases. The seed dressings included in the test and the dosages at which they were applied are listed below (conforming to prescribed rates of application where such information is available).

Table 1. List of vegetable seeds used in seed treatment tests.

Kind	Variety	Source of Seed	Year	Percent germination
Asparagus	Eden	Ottawa, Ont.	1950	85
Soybean	Blackeye	Ottawa, Ont.	1948	86
Bush Bean	Bountiful	Saanichton, B. C.	1948	79
Beet	Detroit Dark Red #16	Univ. of Man., Man.	1944	66
Cabbage	Penn. State Ballhead	Ste. Clothilde, Que.	1951	74
Carrot	Amsterdam	Ste. Clothilde, Que.	1950	71
Citron	Green Seeded	Summerland, B. C.	1947	85
Corn	Banting	Ste. Clothilde, Que.	1950	95
Cucumber	Delcrow	Ottawa, Ont.	1948	87
Dill	Mammoth	U. B. C., B. C.	1950	87
Parsley	Champion Moss Curled	U. B. C., B. C.	1948	61
Muskmelon	Hales Best	Summerland, B. C.	1946	82
Onion	Brigham Yellow Globe	Ste. Clothilde, Que.	1951	86
Parsnip	Short Thick	Morden, Man.	1952	54
Pumpkin	Sugar	Summerland, B. C.	1946	76
Radish	French Breakfast	Saanichton, B. C.	1947	96
Spinach	Bloomsdale Long Standing	Saanichton, B. C.	1948	68
Squash	Kitchenette	Ottawa, Ont.	1944	66
Swiss Chard	Lucullus	Ottawa, Ont.	1948	81
Tomato	Bonny Best	Vineland, Ont.	1943	82
Vegetable Marrow	Long Green Trailing	Agassiz, B. C.	1949	92

Arasan (tetramethyl thiuramdisulfide): 2 oz. per 100 lb. for soybean, bush bean, citron, corn, cucumber, muskmelon, pumpkin, squash, and vegetable marrow; 4 oz. per 100 lb. for asparagus, cabbage, carrot, dill, onion, parsnip, radish, spinach, and tomato; 6 oz. per 100 lb. for parsley; 8 oz. per 100 lb. for beet and swiss chard.

Phygon (1, 3 dichloro 2-4 naphthoquinone): 1 1/2 oz. per 100 lb. for soybean and corn; 2 oz. per 100 lb. for beans; 3 oz. per 100 lb. for muskmelon; 4 oz. per 100 lb. for asparagus, cabbage, citron, cucumber, onion, pumpkin, radish, spinach, squash, swiss chard, tomato, and vegetable marrow; 6 oz. per 100 lb. for parsley

[1]Contribution No. 1330 from the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Canada.

[2]Associate Plant Pathologist, Ottawa.

Table 2. Mean percentage field emergence of vegetable seed treated with various seed dressings based on four samples of 100 seeds each.

Kind of Seed	Un-treated	Arasan	Merculine	Mercusol	Panogen	Phygon	Spergon	Vancide	L.S.D.[a]
Asparagus	70.5	64.75	19.5	62.0	67.25	46.25	72.5	64.75	x[b]
Soybean	3.25	57.25[c]	49.5	26.25	61.5	54.0	43.25	74.75	6.1
Bush Bean	82.5	81.0	62.25	79.0	85.0	88.75	83.0	88.75	6.1
Beet	36.25	47.0	53.5	30.75	57.75	70.0	20.5	82.5	11.8
Cabbage	58.75	54.25	58.25	50.5	55.25	58.75	56.25	51.25	x
Carrot	57.75	60.25	49.0	53.0	61.5	49.5	57.5	63.5	4.4
Citron	32.5	73.25	73.75	46.0	62.25	75.75	76.75	55.0	11.5
Corn	69.5	76.75	66.75	73.25	79.25	77.0	71.75	83.5	5.6
Cucumber	21.25	67.0	43.75	23.75	62.0	62.5	60.75	34.0	8.2
Dill	63.5	63.25	50.0	62.0	69.25	71.75	51.5	56.75	2.6
Parsley	30.75	27.75	19.75	28.0	40.0	30.25	27.5	32.75	6.3
Muskmelon	45.0	51.5	53.25	34.0	37.75	61.0	61.25	43.5	9.7
Onion	69.5	66.0	64.25	63.75	68.75	72.75	69.75	67.5	x
Parsnip	54.0	43.75	41.5	53.5	54.0	39.75	45.0	42.75	x
Pumpkin	56.0	67.0	76.5	63.75	84.75	72.75	64.5	56.0	8.6
Radish	84.25	84.25	78.25	79.0	84.5	80.25	87.25	88.25	x
Spinach	50.5	52.75	36.25	37.5	55.0	60.5	57.25	60.75	9.7
Squash	42.75	56.5	66.75	43.5	66.0	64.25	56.25	43.0	5.27
Swiss Chard	56.0	66.75	127.0	40.5	104.	105.75	49.0	112.5	21.7
Tomato	32.5	27.5	31.5	27.0	32.25	34.5	31.25	15.25	x
Vegetable Marrow	52.25	76.0	84.0	46.0	86.0	86.75	72.5	51.25	6.8

[a] L.S.D. at the 5% level.

[b] No significant increase between treatments.

[c] Underlined numbers indicate significant increase in emergence.

and parsnip; 8 oz. per 100 lb. for beet, carrot, and dill.

Panogen (methyl mercury dicyan diamide): 4 fluid ounces per 100 lb. of seed for all vegetables.

Merculine (Emulgate of 10% phenyl mercury salicylate): 4 fluid ounces per 100 lb. of seed for all vegetables.

Mercusol (Emulgate of 20% copper resinate and 0.4% phenyl mercury salicylate): 4 fl. oz. per 100 lb. of seed for all vegetables.

Spergon (tetrachloro-parabenzoquinone): 3 oz. per 100 lb. for soybean, bush bean, and corn; 6 oz. per 100 lb. for citron, cucumber, muskmelon, pumpkin, squash, radish, spinach, tomato, and vegetable marrow; 8 oz. per 100 lb. for asparagus, onion and cabbage; 12 oz. per 100 lb. for carrot, dill, parsley and parsnip; 16 oz. per 100 lb. for beet and swiss chard.

Vancide 51 (sodium salt of dimethyl dithiocarbamic acid + sodium salt of 2-mercapto-benzothiazole): 8 oz. per 100 lb. of seed for soybeans, bush bean, citron, corn, cucumber, muskmelon, pumpkin, squash, and vegetable marrow; 16 oz. per 100 lb. of seed for asparagus, cabbage, carrot, dill, onion, radish, parsnip, and spinach; 24 oz. per 100 lb. of seed for parsley; 32 oz. per 100 lb. of seed for beet and swiss chard; 5% solution dip for tomato.

Half pound seed lots were used for each of seven treatments in order to get as accurate dosages as possible on the seed. The half pound lots were placed in large wide-mouthed conditioned flasks and a weighed amount of seed dressing added to each flask. The flasks were shaken in a mechanical shaker for five minutes. The seeds were kept in stoppered flasks for two to three weeks then planted in rod rows at the rate of 100 seeds per row. Each treatment was replicated four times and randomized. Emergence counts were taken after two weeks.

From Table 2 it can be seen that no significant increase in emergence was noted for asparagus, cabbage, onion, radish, parsnip, and tomato in any of the treatments used. It is interesting to note that no significant difference in treatments occurred in onion and radish in the previous years's tests (1). Outstanding increases in emergence occurred in soybean seed, for all treatments, in particular Vancide 51 from 3.25 percent emergence in the untreated seed to 74.75 percent. Vancide 51 and Phygon gave significant increases in beans. In treated beet seed Vancide 51 showed an increase from 36.25 percent emergence in the untreated seed to 82.5 percent in the treated seed. Three other treatments also gave a significant increase in emergence. The same treatments also gave significant increases in swiss chard. Vancide 51 was the only treatment which gave a significant increase in emergence of carrot seed.

In general most of the crucifers responded to treatment. All treatments gave a significant increase in emergence in citron seed. All treatments gave a significant increase in emergence in squash, pumpkin, vegetable marrow, and cucumber with the exception of Mercusol and Vancide 51. Phygon and Spergon gave significant increases in Muskmelon.

Four treatments, Vancide 51, Panogen, Phygon, and Arasan, gave significantly increased emergence in corn. Panogen and Phygon for dill and Panogen alone for parsley seed increased the emergence significantly. Phygon and Vancide 51 were the best treatments for spinach.

Of the 21 vegetable seed stocks used, 15 responded to treatment as shown by an increased emergence. Thirteen gave a significant increase with Phygon, 11 with Panogen, nine with Vancide 51, eight with Merculine, seven with Arasan, and two with Mercusol.

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DILUTION OF PANOGEN FOR VEGETABLE SEED TREATMENT[1]

V. R. Wallen[2]

Experiments in 1952 (5) indicated that Panogen, as a seed treatment for vegetables, might be used successfully for improving emergence. In addition, it has been effective in the control of damping-off of Round Pod Kidney Wax beans (1). Some reports have been published on diluted Panogen as a seed treatment. Hansing (2) employed dilutions of 1 part in 4 parts of water and 1 part in 9 parts of water and found that 1 part in 4 was comparable to full-strength Panogen in the control of kernel smut of sorghum. Koehler (3) and Leukel (4) have reported diluted Panogen as effective for the control of oat smut also.

Table 1. Mean percentage field emergence of vegetable seed treated with various dilutions of Panogen based on four samples of 100 seeds each.

Vegetable	Rate of application (oz. per 100 lb. seed), and dilution (parts Panogen:parts water)								
	Not treated	1 oz.				2 oz.			
		Full strength	1:1	1:3	1:9	Full strength	1:1	1:3	1:9
Tomato	40.5	56.0[b]	53.25	41.5	42.75	49.25	42.0	42.75	40.75
Cucumber	9.0	52.0	51.5	25.25	15.5	47.0	47.25	44.5	12.25
Beet	13.5	32.75	29.25	10.75	28.0	36.5	26.0	37.75	12.25
Radish	54.0	57.25	54.75	59.75	60.0	50.5	39.75	45.25	63.75
Bean	50.5	49.5	57.0	61.0	52.75	54.25	52.75	56.0	51.0
Corn	15.5	19.0	18.75	16.75	14.0	23.25	19.75	14.75	14.75

Vegetable	Rate of application (oz. per 100 lb. seed), and dilution (parts Panogen:parts water)								
	4 oz.				8 oz.				
	Full strength	1:1	1:3	1:9	Full strength	1:1	1:3	1:9	L.S.D.[a]
Tomato	56.0	54.75	40.75	39.25	58.75	52.0	41.5	42.5	6.66
Cucumber	57.0	52.5	22.75	9.5	53.0	52.0	40.0	39.25	6.76
Beet	32.0	27.75	17.5	26.5	53.25	29.25	24.75	40.5	10.79
Radish	72.25	56.0	61.75	64.5	58.0	49.0	44.25	50.25	10.38
Bean	63.75	63.75	48.5	44.0	63.0	55.0	46.25	51.25	6.13
Corn	25.75	20.5	26.25	14.25	27.75	28.75	21.25	19.25	5.88

[a] L.S.D. at the 5% level.

[b] Underlined numbers indicate significant increase in emergence.

In the tests reported here, undiluted Panogen was compared with dilutions of 1:1, 1:3, and 1:9 with water, applied to the seed of six vegetables, for its effect on emergence. In addition, the rate of application was varied, using 1, 2, 4, and 8 oz. per 100 lb. of seed. For each of the 17 treatments of the six vegetables, namely tomato, cucumber, beet, radish, bean, and corn, 2 ounces of seed was used.

[1] Contribution No. 1331 from the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Canada.

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The seed dressing was applied by placing the seed in a conditioned flask and adding the Panogen by means of a pipette on the wall of the flask. The flask was placed on a mechanical shaker and shaken for five minutes. The seed was kept in the flask for one week, then planted in rod rows of 100 seeds each, randomized and replicated four times. The results of emergence counts are summarized in Table 1.

From Table 1 it can be seen that, for tomato, Panogen is most effective at full strength applied at the rates of 1, 2, 4, and 8 oz. per 100 lb. of seed. Panogen at 1:1 significantly increased emergence; however higher dilutions were not effective. All treatments except the 1.9 dilution significantly increased emergence in cucumber, but emergence in the check was extremely low. For beet seed all treatments at 1:1 significantly increased emergence, as did the full-strength Panogen. Full-strength Panogen at 4 oz. per 100 lb. of seed was the only treatment that significantly increased emergence of radish. Full-strength Panogen at the 2 oz., 4 oz., and 8 oz. levels significantly increased the emergence of corn; however, the 8 oz. level at a 1:1 dilution was also equal to Panogen at full strength. No trend could be noticed for the treatment of beans, and it would appear that the full-strength Panogen would be the most suitable treatment.

From the above results it would appear that undiluted Panogen is the best strength for corn, bean, and radish. For tomato, cucumber, and beet either the Panogen full strength or diluted 1:1 with water appear to be satisfactory.

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CHLOROPICRIN AEROSOL TREATMENT OF COMPOST PILES

A. G. Newhall

Chloropicrin as a fumigant has been applied to soils in the past with some sort of injection apparatus. Its availability now as an aerosol under pressure containing 50% methyl chloride as a propellant makes it as easy to apply to piles of compost under a gas tight tarpaulin as methyl bromide has been.

To find out the proper dosage rate two compost piles were screened and divided into 5 1-cubic yard batches (22 bushels each). The tops were leveled off at 1 foot elevation and a dozen holes poked in each, approximately 8 inches apart by 8 inches deep, with a broom handle. A few empty flats were laid on each pile and a polyethylene tarp laid over them. Sand snakes and soil were laid around the edges for a seal and the chloropicrin aerosol (Larvacide) was applied with a plastic tube under the tarp by placing the container on a scales and opening a valve until the scales indicated release of the desired amount. In this way 1/2, 1, 1 1/2, and 2 lbs. were applied to the four respective piles. The tarp was left on for 48 hours, after which soil samples were put in flats, brought to Ithaca and two weeks later were sown with several kinds of vegetable seeds to test for damping-off control.

The soil from farm B was a light brown sandy loam without much organic matter and with a moisture content of 14.3 percent. That from Farm A was a black loam with a great deal of organic matter and with 31.5 percent moisture, dry weight basis. The heavier, wetter soil required a heavier dosage.

On farm A an additional test was made by filling 30 flats with the soil, piling them 3 feet high, and fumigating this pile at the rate of 1 lb. per cubic yard. This would presumably disinfest the flats. On farm B where the soil had less moisture and organic matter the 2 lb. rate fumigation was omitted and a treatment with 1 lb. of methyl bromide was included for comparison, as shown in Table 2. Stands of seedlings and weeds are recorded in Tables 1 and 2.

Table 1. Control of weeds and damping off from fumigation of compost soil with Larvacide (chloropicrin) aerosol at indicated rates. Soil fumigated June 11, seed sown June 29, 1953. Black compost soil from Farm A.

Rate per cubic yard	Number of weeds per flat	Number of vegetable seedlings from indicated number of seeds sown: Cucumber (35)	Pea (33)	Cauliflower (75)	Beet (75)	Tomato (75)	Pepper (45)
Check	29	14	16	7	15	54	28
1/2 lb.	16	32	33	41	134	59	39
1 lb.	21	32	32	41	56	59	27
1 1/2 lb.	4	32	32	68	156	64	30
2 lb.	0	35	32	70	126	61	37
Soil in flats at 1 lb.	0	29	33	66	121	66	34

Post emergence damping-off and weed growth were both prominent in the black compost of Farm A (Table 1) at rates of 1/2 and 1 lb. per cubic yard, especially in cauliflower and beets. At the 1 1/2 lb. rate, however, control was good. With soil in flats, the 1 lb. rate seemed adequate. Checks were very bad, except tomato and pepper. Pythium is believed to be chief damping-off organism controlled.

Whether lower moisture, reduced organic matter, or lower inoculum potential was responsible for success of the lowest dosage rate in the lighter soil of Farm B is not clear, but the last named factor seems likely.

FIGURE 1. Left, untreated compost soil from farm A. Right, same soil fumigated with 1 1/2 lbs. chloropicrin aerosol per cubic yard under plastic tarpaulin.

Table 2. Control of weeds and damping off from fumigation of compost soil with Larvacide aerosol and methyl bromide at indicated rates. Soil fumigated June 11, seed sown June 29, 1953. Light sandy loam soil from Farm B.

Treatment Rate per cubic yard	Number of weeds per flat	Number of vegetable seedlings from indicated number of seeds sown: Cucumber (35)	Pea (33)	Cauliflower (75)	Beet (75)	Tomato (75)	Pepper (45)
Check	35	22	25	33	28	58	29
Larvacide							
1/2 lb.	3	45	28	60	133	60	32
1 lb.	2	34	28	66	138	57	39
1 1/2 lb.	4	33	30	63	123	54	36
Methyl bromide at 1 lb.	1	34	32	66	144	62	34

The lowest satisfactory dosage rate in these tests, on the basis of weed seed and damping-off control obtained, is concluded to be 1 1/2 lbs. per cubic yard of soil. There is some evidence that 1 lb. might be enough for some light soils. What the dosage should be for the sclerotia of several fungi remains to be determined.

Figure 1 shows seedlings of cucumber, pea, cauliflower, beet, tomato, and pepper in treated and untreated soil of high organic and moisture content from Farm A.

This method of introducing chloropicrin gas under a tarp is believed to be entirely feasible, and a satisfactory dosage rate is suggested. It must be kept in mind that the fumigant employed was a 1-1 mixture of chloropicrin and methyl chloride propellant. This means that the suggested rate of 1 1/2 lbs. is virtually the same as the 3/4 lb. rate of straight chloropicrin advocated heretofore in the injection method. Soil temperatures should be above 60° F.

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EARLY DEFOLIATION OF POST OAK IN THE SOUTHEAST IN 1953

W. A. Campbell and J. H. Miller

Post oak (Quercus stellata) is a common yard and grove tree in Georgia, especially on the dry ridges and plateaus of the Piedmont. In this area post oak is a hardy tree and is rarely seriously affected by adverse climatic conditions. Although rarely planted as a shade tree, it occurs in urban as well as rural areas mainly because existing trees were retained at the time homes, churches or other buildings were constructed. Many of these have now reached large size and are highly prized for shade. The present poor condition of thousands of post oaks of all sizes in North Georgia and parts of North Carolina and South Carolina in contrast to the generally good condition of other oak species deserves recording as an example of the seasonal development of severe foliage deterioration. The interest of the general public in the unusual condition of post oaks in Georgia is reflected in the number of inquiries received by pathologists and foresters from landowners who felt that their trees were threatened by some new disease.

FIGURES A and B. A, Partially defoliated post oak on right; white oak on left. B, Severely defoliated post oak growing between water and red oaks with normal foliage.

In general, post oaks have been conspicuous the past season because of their abnormal appearance. The foliage on many trees has been thin all season and confined mainly to bunchy tufts at the ends of the branches. Many small limbs died. Leaf browning started in mid-summer and by late summer many trees had a distinctive brownish-green color. Premature leaf fall was common and all degrees of defoliation occurred. A few trees died. So unusual was the appearance of post oaks that they could be identified readily at a distance by their bronze to brown, tufted foliage. The contrast between post oaks and other oak species was particularly noticeable because most associated white oaks, water oaks, and red oaks remained green throughout the summer with full crowns and normal leaves.

Close examination of the leaves disclosed that they were generally smaller than normal. Furthermore many failed to unroll completely and their margins were puckered and curled. Later in the season browning, which started at the margins, progressed inward, finally involving large areas of the leaf. Some leaves turned completely brown; these were shed early or remained tightly attached to the twigs.

The first inquiries concerning post oak were received in June. Trees examined at that time had bunchy foliage, normal green in color but confined in tufts to the ends of the branches. The leaves were badly cupped and rolled and did not expand to normal size. The reduced leaf size and the tendency to curl accounted for the tufted appearance of the foliage. Although damage from leaf blister, caused by the fungus Taphrina caerulescens, was widespread on other

oaks, post oak was only slightly affected. Most leaf injury appeared to be associated with a severe frost that occurred on April 7. At that time post oak leaves were just unfolding and were very susceptible to frost. Severe frost damage, which actually killed young leaves, was noted in South Carolina and as far south as central Georgia. Although later deterioration of the foliage of post oaks was not related to frost, the original stunting and curling of the leaves was probably caused by it.

Throughout the season leaves were examined at various times for insects and leaf-inhabiting fungi. Lacebugs, mites, thrips, aphids, scale insects, and a small gall-forming insect were abundant. However, not all of these insects were abundant on the same trees or in the same localities. The insect population, especially lacebugs and mites, was unusually high all summer.

Powdery mildew, caused by Phyllactinia corylea, was less abundant than usual toward the end of the season due to the large number of brown leaves which it did not attack. Other leaf-inhabiting fungi, although present, failed to attack all leaves on a tree or all trees in a locality and hence leaf necrosis could not be associated with any one organism.

No definite cause was found for the deteriorated condition of the foliage of post oaks. Several trees that lost many leaves early in the season put out a new crop in September. The main symptoms were suggestive of drought injury, but other oaks usually considered more susceptible to drought than post oak appeared normal or nearly so even when growing in close association with post oak. Frost injury probably accounted for the crop of small deformed leaves early in the spring. Leaf blister and the unusually high population of leaf feeding insects probably contributed to browning later in the season and the premature loss of leaves.

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STERILE DISTILLED WATER AS A MEDIUM FOR THE ISOLATION OF THE OAK WILT FUNGUS

T. W. Bretz

The ability of Endoconidiophora fagacearum to sporulate readily in submerged liquid culture has been reported by Barnett.[1] He pointed out that when fresh wood chips (bark removed) from oak wilt trees are placed directly into tubes of a liquid medium, the characteristic condiophores and conidia are formed within five days at 25°C. The specific composition of the medium used apparently was of little importance. Even distilled water proved satisfactory.

So far as is known, little or no use has been made of this simple medium and technique for the routine isolation of the oak-wilt fungus. During the past summer a comparison of the rate of recovery of the fungus in sterile distilled water blanks versus malt agar plates was made. Several hundred samples received in the laboratory for oak wilt identification were used in the test. After surface sterilization and bark removal, 12 to 16 wood chips were cut from each twig specimen cultured. One-half of the chips were placed in sterile distilled water blanks. The remainder were planted on agar plates. Tubes and plates were incubated at 25°C. The results are summarized in Table 1.

Table 1. Comparison of recovery of Endoconidiophora fagacearum in sterile distilled water versus malt agar.

Samples cultured	Total number	Percent recovery
A. Samples[a] on which data were taken	272	
B. Samples positive[b] in H_2O or agar	178	65.44
C. Samples positive in H_2O	173	63.60
D. Samples positive in agar	122	44.85
E. Samples giving same results in each medium (difference between 272 and F & G)	211	77.57
F. Samples positive in H_2O but not in agar	56	20.58
G. Samples positive in agar but not in H_2O	5	1.83

[a] Samples consisted of four twig specimens, each cultured separately.

[b] Results recorded as positive when E. fagacearum was recovered from any one of the four twig specimens in a given sample.

It is evident from these data that sterile distilled water compares very favorably with malt agar medium in the recovery of the oak-wilt fungus from routine, wilt-infected samples. In 77.57 percent of the samples cultured, the results in water and on malt agar were identical, that is, they were either oak wilt positive or oak wilt negative.

In 20.58 percent of the cases, oak-wilt-positive readings were obtained in water when comparable samples on malt agar gave negative readings. Conversely, in 1.83 percent of the cases the oak-wilt fungus was recovered on agar plates when comparable samples in water were negative. This represents a net gain of 18.75 percent recovery in water over the recovery obtained with malt agar medium. Sterile distilled water is not, however, a selective medium for E. fagacearum. Contaminants may also develop if present. In a number of instances, however, it was possible to identify by microscopic examination the oak-wilt fungus in the presence of more vigorously growing contaminating organisms. Successful recovery of the fungus in water was also possible from some specimens that were considered too dry for successful isolation on nutrient agar. These instances, plus the virtual elimination of air contaminants as a contributing factor to successful culture work, probably account for the greater percentage of recovery of the oak-wilt fungus in water as compared with the recovery on malt agar plates.

Mycelium of the fungus from the wood chips in water usually was well developed within five to seven days, at which time a majority of the isolates had sporulated sufficiently to permit

[1] Barnett, H. C. 1952. A rapid method for determining oak wilt. Phytopathology 42: 57.

ready identification by microscopic examination. Some isolates that were slow to sporulate could be identified by the presence of the characteristic abortive conidiophores described by Barnett.[2] Ten to 12 days after isolation the fungus had grown sufficiently in most cases to form a pellicle on the surface of the water. This growth closely resembled in cultural characteristics the growth of the fungus on nutrient agar. All identifications were made on the basis of microscopic examination. But with experience it became possible to identify the fungus with considerable reliability on the basis of its gross cultural characteristics in water. No great difficulty was encountered in obtaining stock cultures from the water blanks by direct transfers to nutrient agar slants. Pure cultures were obtained in 88 percent of the cases by this method. Very few of the isolates were lost because of the inability to separate E. fagacearum from the contaminating organism.

It is believed that the use of sterile distilled water blanks provides a simple and reliable technique for the isolation of the oak-wilt fungus. Water blanks are easily and quickly prepared in quantity. Growth and identification of the fungus is quicker than on most nutrient agar media. The problem of air contaminants is markedly reduced. Moreover, there are indications that recovery of the fungus from dry or overage specimens may be more readily accomplished in water than on agar media.

Use of the water blank isolation technique in the field has been investigated to a limited extent. In conjunction with a study that involved extensive sampling of a number of trees, more than 600 isolations were made by this means at the site at the time of sample collection. No attempt was made to incubate the tubes at optimum temperatures for the growth of the oak-wilt fungus until the samples were taken to the laboratory several days after the field isolations were made. Recovery of the fungus was as good as that obtained by the standard laboratory isolation methods from comparable samples handled in the customary manner. Contamination of tubes by air contaminants was negligible. In certain instances, therefore, when field isolation may be preferable to the standard procedure of sample collection and shipment to the laboratory, sterile water blanks provide a satisfactory solution.

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[2] Barnett, H. L. 1953. Isolation and identification of the oak wilt fungus. West Virginia Agr. Exp. Sta. Bul. 359T.

BUTT ROT OF QUEEN PALMS IN FLORIDA ASSOCIATED WITH GANODERMA SULCATUM

J. F. L. Childs[1] and Erdman West[2]

The queen palm (Arecastrum romanzoffianum (Cham.) Becc.), still called Cocos plumosa in the trade, is a widely planted ornamental in Florida and normally is relatively free of parasitic diseases. However, when surrounded by shrubs or planted in damp locations, it may be subject to butt rot.

Attention was recently attracted to two queen palms approximately 17 years old growing on U. S. Department of Agriculture station grounds in Orlando, Florida, because of their defoliated condition (Fig. 1, A). Both trees were supporting sporophores (Fig. 1, B) of a basidiomycete identified by the junior author as Ganoderma sulcatum Murrill. After inspecting parts of two sporophores, J. A. Stevenson, of the United States Department of Agriculture Division of Mycology and Plant Disease Survey, concurred in this identification.

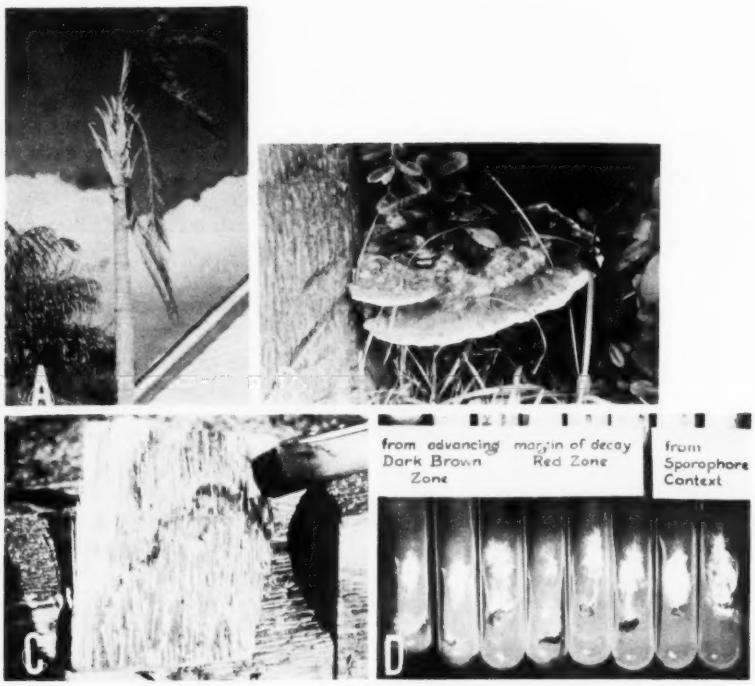

FIGURE 1.--A. Severe defoliation of queen palm caused by butt rot. B. Sporophores of Ganoderma sulcatum on the palm trunk. C. A section of the trunk excised to show the advancing margin of infection with dark border. D. G. sulcatum isolated from the brown border and the red zone immediately behind it and from the sporophore.

When the palms were felled (for reasons of safety) the butt of each was found to be in an advanced state of decay. Splitting open the trunk revealed that the advancing margin of the decayed region had progressed some 24 inches up the trunk. The more recently invaded tissue was beef-red in color with a dark brown outer border (Fig. 1, C) as dense and hard as the uninvaded portions. Towards the base of the trunk the tissues were almost straw yellow and were progressively softer, possibly as a result of the removal of lignin from the tissues by the fungus. Isolations were made from the context of the youngest and most actively growing

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sporophore and also from the brown and red regions of the palm trunk. From the three locations was obtained a fungus that made a white cobwebby growth on potato-dextrose agar slants (Fig. 1, D). In time there was produced in each tube one or more tan-colored sclerotium-like bodies that darkened to leathery-brown with age. The fungus in culture was identified as G. sulcatum by the junior author. Rhoads (1) reported G. sulcatum fruiting on bases of dying queen palms at Cocoa and Clearwater. It has also been reported on dead stalks of the saw palmetto (Serenoa repens (Bart.) Small). The cabbage palm (Sabal palmetto (Walt.) Lodd.) has been listed as a host by Seymour (2) and Murrill (3).

The same fungus has been observed fruiting on the trunks of dying queen palms in Inverness, Sarasota, and Mountain Lake, always in situations where the palm trunks were densely shaded by surrounding exotic or native shrubbery.

It is the opinion of the authors that under the environmental conditions mentioned G. sulcatum can be a facultative parasite of queen palms.

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CARNATION PIMPLE

W. D. Thomas, Jr., and Lester E. Dickens[1]

A yellow pigment-producing bacterium has been isolated from pimple-like spots on the leaves and stems of carnations (Dianthus caryophyllus). The pimples are about 1 mm. in diameter, and appear first near the base of the leaf on the ventral side (Fig. 1). More pimples form nearer the tips of the leaves. The pimples make their appearance first in the upper portions of the plant. Leaves of severely infected plants may shrivel. There are no other visible symptoms. Sections of infected leaves stained with basic fuchsin and a counterstain of light green showed evidence of bacteria within the xylem. It was noted in a number of cases that some of the cells in the infected area were abnormally enlarged as compared to uninfected cells. The action of the bacteria upon the cells, causing hypertrophy, may explain the presence of the pimples on the surface.

FIGURE 1. Symptoms of carnation pimple.

Pathogenicity has been demonstrated on the carnation varieties, White Patrician and Miller's Yellow. The disease was reproduced by inoculating plants, which had been grown in pots of sterilized soil for five months, with 40-hour bacterial suspension in beef broth used as inoculum. The bacterium was also transmitted to Dianthus barbatus with similar results.

Soil inoculations were made by applying 25 ml. amounts of the bacterial suspension diluted with 25 ml. of sterile distilled water directly to the soil. In one series the roots were mechanically injured by probing the soil with a stick, and in another series the plants were not injured. A third treatment consisted of spraying the stems and leaves liberally with a bacterial suspension. A non-inoculated control was included. Each treatment was replicated six times.

Characteristic pimple-like blisters appeared within four days on the stems and leaves of those plants which were treated by soil inoculation. The results indicated that the organism could invade the tissue in the absence of wounds, and that it seemed to be well adapted to rapid migration or translocation to the upper parts of the plant. The plants treated with the foliage spray showed symptoms in four to eight days.

Some difficulty was experienced in the reisolation of the bacterium. Potato dextrose agar plates were employed to retrieve the organism, but this method proved to be inadequate. Cross sections of stems and leaves from all plants were surface sterilized with 1:1000 $HgCl_2$, rinsed in sterile distilled water, placed in nutrient beef broth with pH 5.9, and incubated at 23° C. for four to six days. One loop from each broth tube was streaked on potato dextrose agar. The bacterium in all cases was recovered.

A search of the literature does not reveal that this organism has been previously described

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[1] Plant Pathologist and Research Assistant supported by the Colorado Flower Growers Association, respectively. Published with the approval of the Director, Colorado Agricultural Experiment Station, as Scientific Journal Series No. 425.

as a carnation pathogen. On the basis of numerous morphologic and physiologic tests performed,[2] it closely resembles the description of Xanthomonas oryzae (Uyeda & Ishiyama) Dowson.[3] It differs from this description, however, in the failure to produce acid from glucose, lactose, and sucrose. The optimum temperature is 25° to 27°C. On the basis of these differences, and its pathogenicity on Dianthus species, the organism is considered to be a new variety of Xanthomonas oryzae, to be described elsewhere.

COLORADO AGRICULTURAL EXPERIMENT STATION.

[2]The assistance of Robert Borland is gratefully acknowledged.

[3]Breed, Robert S., B. G. D. Murray, and A. Parker Hitchens. 1948. Bergey's Manual of determinative bacteriology. 6th ed. The Williams and Wilkins Co., Baltimore, Maryland.

BRIEF NOTES ON PLANT DISEASES

RINGSPOT OF PRIVET IN TEXAS

By E. M. Hildebrand

FIGURE 1.

In 1948 ringspot symptoms were observed on a California privet (Ligustrum ovalifolium) hedge in College Station, Texas. While the leaves came out normal in size and appearance in the spring they were soon recognizable from a distance by three symptoms which became more marked as the season advanced, namely, smaller size, lighter green color, and premature defoliation. After an unusually cold spell of winter weather when the temperature dropped to -5° F., affected plants compared to symptomless ones showed more severe winter injury, and even death in some instances. The affected plants also showed less vigor as the season advanced. Figure 1 illustrates ringspot leaf symptoms photographed in mid-May 1949.

The three transmission trials were unsatisfactory because controlled greenhouse facilities were unavailable. Approach-grafting using neighboring plants resulted in good unions and apparent transmission, though it was not possible to certify that the symptom-free material was disease-free at the start. This note is being submitted on the possibliity that others may have more information on privet ringspot than is herein presented.

PLANT DOCTOR SERVICE, HOUSTON, TEXAS.

NOTES ON PLANT DISEASES IN CONNECTICUT DURING 1953

By Saul Rich

During 1953, an early warm, wet spell caused the discharge of most of the ascospores of the apple scab fungus, Venturia inaequalis, before the opening of the apple buds. Because of this, primary infection was comparatively light. Most of the important scab development was from conidial infection. During the three or four years prior to 1953 unsprayed McIntosh trees were almost completely defoliated by apple scab. In 1953, however, comparable trees, although about 50 percent infected, retained most of their foliage.

E. M. Stoddard reported a severe case of sclerotiniose (Sclerotinia sp.) on beans. Not only were the pods infected, but lesions and mold growth were abundant on all the aerial portions of the plants. This field had been in lettuce the previous year. The lettuce had shown a great deal of drop-rot.

Cabbage and cauliflower were moderately infected with black rot (Xanthomonas campestris) in some local areas. In some cases, infection could be traced back to diseased seed.

Cucumber scab (Cladosporium cucumerinum) was rather severe in certain fields, just as it had been during the 1952 growing season.

Sweet corn had scattered infections of Stewart's wilt (Bacterium stewarti). This disease was most noticeable on the variety North Star. The infection was not severe enough, however,

however, to cause a great deal of loss. Many sweet corn plants showed the red root discoloration associated with infection by Fusarium moniliforme. In one instance, this organism was isolated from the discolored roots.

Lettuce big vein (virus) was not so generally severe this year as it had been in previous years. In at least one field, however, about 85 percent of the plants showed symptoms of big-vein.

Late blight (Phytophthora infestans) caused no damage to tomatoes. Alternaria solani, however, caused serious defoliation in certain areas. Because of the very warm summer, Fusarium wilt (F. oxysporum f. lycopersici) was more common on field tomatoes than it has been in previous years. Ordinarily, Fusarium wilt is hardly ever found on field-grown tomatoes in Connecticut. One or two cases of bacterial wilt (Pseudomonas solanacearum) were reported on tomatoes this year.

A wilting disease developed on snapdragons, variety Afterglow, which were being used to test protective fungicides. The wilt was most damaging in low, damp areas of the field. Eventually, 30 percent of the plants were killed. A Verticillium of the dahliae type was recovered from the wilted plants.

DEPARTMENT OF PLANT PATHOLOGY & BOTANY, THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN 4, CONNECTICUT.

ATTENTION PLEASE!

TO: Collaborators and other Cooperators of the Plant Disease Survey
FROM: Paul R. Miller
SUBJECT: Material for use in the FAO Plant Protection Bulletin

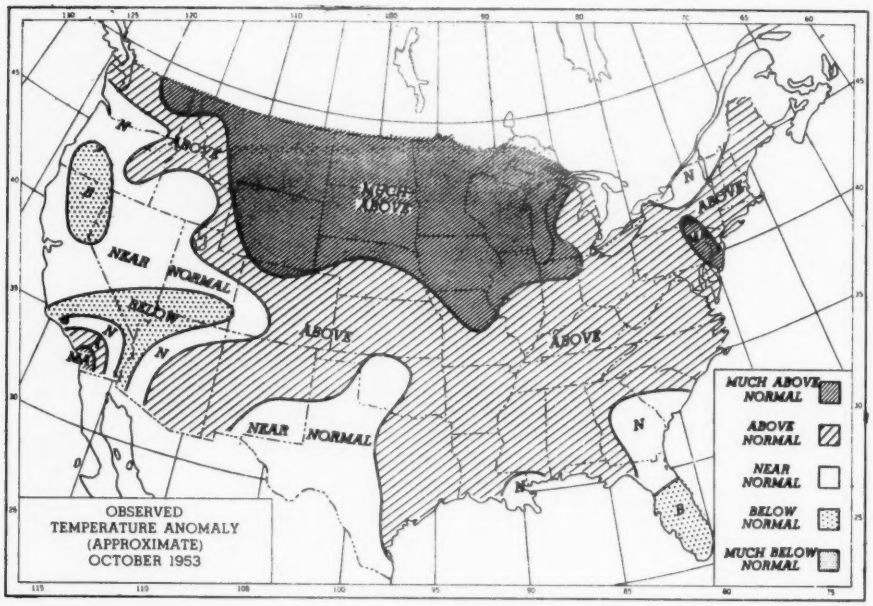
As reported previously in the Plant Disease Reporter (37: 492, 1952), the Plant Disease Survey is official correspondent to the Plant Protection Bulletin, of the Food and Agriculture Organization of the United Nations, for plant disease information from the United States.

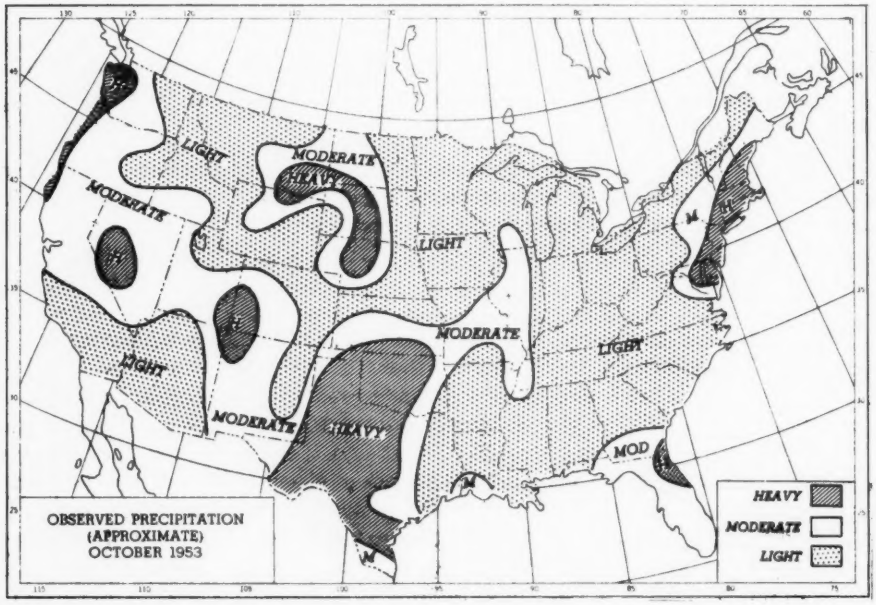
So far, to fulfill our obligations to the Organization and the Bulletin, we have been using articles from the Reporter as basis, sometimes abstracted or combined, usually somewhat condensed. Use of the names of the original authors would simplify adaptation of reports for the Bulletin, but we have not been citing them because of possible objections. We should like to have your permission to use your names for this purpose and to know that it is agreeable to you for us to utilize your material in this way.

The task of official correspondent is to obtain information and transmit a report on plant diseases for publication each month. As I said before, we would appreciate it if plant pathologists would send us suitable material from time to time for inclusion in our reports, clearly marked so that we will know it is intended for the Bulletin. Topics suitable for the Bulletin (as regards plant diseases; of course insects are covered too) include incidence and spread of diseases of immediate or potential danger, occurrence of diseases in areas previously free, unusual infections of plant products, effective methods and materials for controlling diseases, major operations for preventing or controlling diseases. The Bulletin also publishes notices of quarantine measures, and of action implementing the International Plant Protection Convention and supplementary agreements. From time to time comprehensive reviews of the occurrence and significance of plant diseases in a specific region or related to a specific crop, and summary accounts of the biology and control of specific diseases of international importance, will be presented.

The International Plant Protection Convention, approved by the FAO Conference at its Sixth Session in 1951, provided for the establishment of a World Reporting Service on Plant Diseases and Pests, to collect and disseminate information on the incidence of plant pests and diseases of economic importance in different countries, on the degree of damage they cause, and on their control. The FAO Plant Protection Bulletin is the medium through which this information is circulated. Evidently, the extent to which the World Reporting Service and the Bulletin "can contribute to the progress of plant protection will depend upon the extent of co-operation received", as L. E. Kirk, Chief of the Plant Production Branch, Agriculture Division, FAO, says in introducing the first number (Vol. 1, no. 1, October 1952).

I feel that helping to make both the World Reporting Service and the Bulletin a success is an important undertaking for each of us in the Plant Disease Survey.





The terms used in the accompanying maps, which define the ranges of temperature and precipitation, are numerical class limits. These are based on a statistical analysis of past records through which is determined the normal frequency of occurrence of temperatures and precipitation at various times of the year for different locations. For temperature the classes above, below, and near normal are so defined that they each normally occur one-fourth of the time; much above and much below normal, one-eighth of the time. Precipitation is depicted in terms of light, moderate, and heavy, each class normally occurring one-third of the time and thereby having equal probability of occurrence. These maps graphically represent only the general trends and give the country's weather picture at a glance. For quantitative studies, where monthly mean temperatures and actual precipitation records are needed for a given time and place, other publications of the Weather Bureau should be consulted. P. R. M.

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